THE MODEL ENGINEER

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The MODEL ENGINEER

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4TH MAY, 1950 VOL. 102 NO. 2554

SMOKE RINGS

A New Competition Trophy

● MR. M. MALTBY, of Sheffield, has very kindly donated a new trophy which will be awarded annually at the "M.E." Exhibition, subject to the following conditions :—

It will be known as THE MODEL ENGINEER Ship Model Societies Challenge Trophy, and is to be open for competition by ship model societies exhibiting at the "M.E." Exhibition. The trophy shall be competed for annually, commencing 1950 and lasting till 1959. The society gaining the award shall have its name engraved on the shield provided on the rim for that purpose. In 1959, the society which has registered the greatest number of wins on the trophy will retain it permanently and engraving to that effect may be inscribed on the centre boss of the wheel. In the event of a tie, the ultimate retainer shall be decided at the 1960 "M.E." Exhibition, and the society gaining the most points shall be declared the winner.

We anticipate some keen competition for this very desirable prize, especially in view of the fact that, usually, the standard of workmanship in ship models reaches a very high calibre.

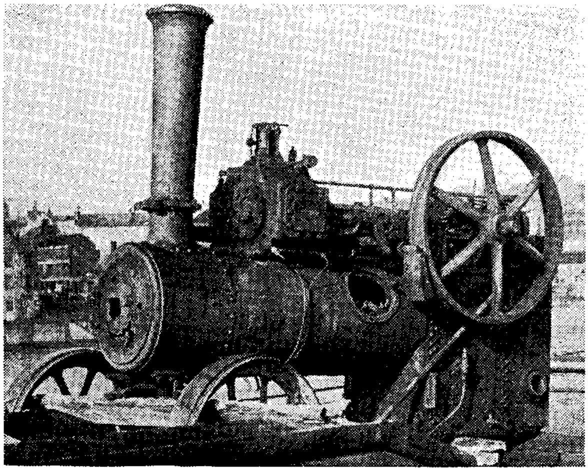
American Traction Engine Drawings

● MINIATURE ENGINE LABORATORIES, of Sandusky, Ohio, U.S.A., have written with reference to our recent comments about the comparative scarcity of drawings and parts for miniature tractions. The firm supplies castings and drawings for a 1-in. scale model of a J. I. Case 65-h.p. tractor of 1909. The drawings are actual 1-in. scale reductions of the original production drawings, and the castings, numbering forty, are in hard bronze. If sufficient interest is aroused, these drawings and castings could be made available in England through our well-known advertisers, A. J. Reeves & Co., of Birmingham.

This is interesting news, and we would like to see an actual model of an American traction engine. As we write these notes, we have before us an illustration of one of the J. I. Case models referred to ; it is quite a spectacular job with plenty of "works," while its "wire-spoke" form of wheels would provide a novelty for English traction enthusiasts. After all, a traction engine is a traction engine anywhere in the world, and its astonishing variety is one of its chief allurements.

On the Scrap-heap

● THE PHOTOGRAPH reproduced on this page was taken by Mr. G. Banfield, of Cardiff, when he was in Cornwall during March. It shows an old traction engine in process of disintegration for scrap at a wharf in Penzance. The engine bears a plate engraved with the legend : " Ruston & Hornby Ltd., Class S.C., 114181, Lincoln, Eng."



Mr. Banfield writes : " The subject of my photograph was born in 1903, spent its working life at some quarries near Penzance, and was then taken for power supply in connection with the salvage of H.M.S. *Warspite*, when that ship was wrecked off Lands End two or three years ago. The engine proved unsuitable, and was brought back as scrap ; it now stands in the same dump as pieces of the *Warspite*—honoured company indeed ! "

The Churchward Touch

● THE INSTITUTION of Locomotive Engineers was recently the scene of one of the most enthralling, most personal and most deeply moving experiences that can ever have occurred at a gathering of technical experts. The occasion was a lecture dealing with G. J. Churchward, the man and his work, given by Mr. K. J. Cook, a former pupil of Churchward's and now Mechanical and Electrical Engineer, British Railways, Western Region.

After the official opening of the proceedings, the company listened in wrapt attention to Mr. Cook's forthright account of the character, aims and achievements of a great engineer. Here was no empty rhetoric, no maudlin sentimentality, but a plain statement of facts, of ideas and how they were worked out, of many schemes, some of which terminated successfully, others not so successfully ; but, above all, of a lovable personality who became the dominating influence, not only in the factory over which he ruled, but in the whole town of Swindon. He was firm, brusque, but ever just with all who served under him ; he shunned publicity, yet he became one of the best-known and most respected figures in the engineering profession ; and with it all he was loved—almost worshipped—by nearly everyone with whom he had any direct dealings. His life was ever full, devoted to the service of his fellow-men ; his end was tragic in the extreme and occurred one foggy morning in December, 1933, when, as he was crossing the railway by a well-trodden path to the factory from which he had retired twelve years before but could not tear himself away, he was knocked down and killed by one of his own engines

There are probably many who departed homewards, that evening, more than ever convinced that Churchward was, and must remain in history, the brightest light in the galaxy of great locomotive engineers.

The 1904 Railway Speed Record

● WE HAVE received a number of letters as a result of our comments under the heading " Beginning Again ? " in the February 16th issue. Nearly all of them ask why it should have been necessary to change engines at Bristol on such a run, and whether the 4-4-0, *City of Truro*, could not have run non-stop to Paddington.

To answer the latter question first, the stop at Bristol was necessary so as to detach some vans that contained mails which were destined for South Wales and the north of England. The change of engines was almost a last-minute decision ; *City of Truro* was not steaming very well, and Inspector Flewellyn, who was travelling on the footplate, thought that he would feel more comfortable in his mind if a fresh engine were used for the Bristol-London portion of the run. The singlewheeler *Duke of Connaught* was standing-by with steam up, ready to take over in case of any trouble ; so the " *City* " was taken off and replaced by the singlewheeler. What followed is, of course, well known ; *Duke of Connaught* ran the 118½ miles to London in 99 min. 46 sec., including a slack to 3 m.p.h. over a new bridge at Swindon. The 77¼ miles from the Swindon check to the stop in Paddington station were covered at an average speed of exactly 80 m.p.h.

Obituary

● WE MUCH regret to learn of the passing of another old friend, Mr. Frank Hope-Jones. Although he was not essentially a model engineer, his name was known all over the world ; for he was one of the leading horologists of our era and will ever be associated, in the public mind, with the introduction of the six-pip time signal of the B.B.C.

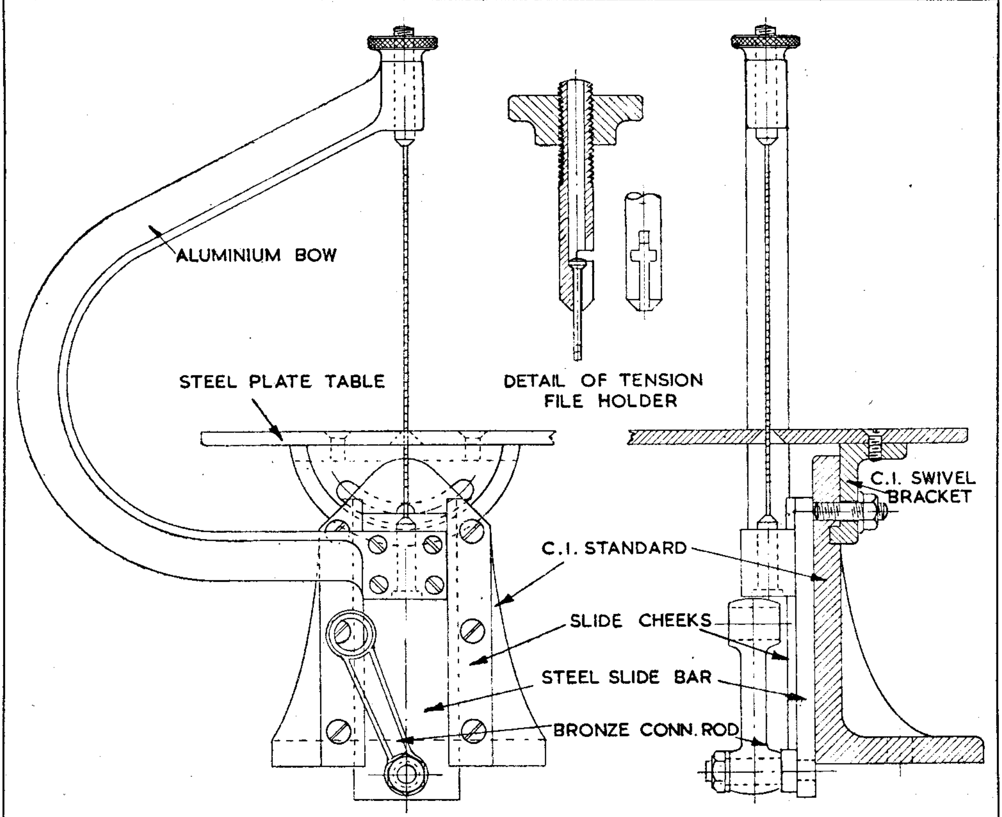
He was the author of books on horological subjects, including our book, *Electric Clocks and How to Make Them*. Only recently, he was in our office discussing horological matters, and, in spite of his 83 years of age, he was physically and mentally as alert as we have ever known him. As a member of the Council of the British Horological Institute, his prestige and influence were widely appreciated.

A Sawing and Filing Attachment for the Lathe

by "Ned"

TO craftsmen of the old school, the penchant of the modern engineer to use a machine at the least provocation, on all sorts of jobs which in former days were done by hand, may appear to be signs of degeneration. It is often argued that every rise in the variety and application of machine tools represents a decline in the manual dexterity of the workers. Like most sweeping generalisations, however, this is not completely true ; while many modern machines can be operated by workers with very little skill, the true craftsman is just as necessary as ever in the engineering industry, and his skill, though changing in nature, cannot be said to be inferior to that of his predecessors. The modern machinist who produces a lathe bed by means of a vertical mill and a slideway grinder may not be capable of doing a similar job by the use of a hammer and chisel, file, and scraper, as his grandfather did—but he is required to work to a very much higher standard of precision, not to mention a speed of production entirely beyond the bounds of physical possibility when purely manual methods were employed.

Quite apart from the obvious need to employ machines wherever possible in quantity production, the individual worker can often obtain great benefit from them, in operations where speed is of much less importance than precision. In the tool room of a modern production factory, where the individual worker has great responsibility, and must exercise considerable intelligence as well as manual skill, the advance of the machine tool is no less marked than on the production line. A department of manufacture which is very prominent at the present time, is that which involves the use of very cunningly devised and accurately formed tools for such



General arrangement of sawing and filing attachment for 3½ in. lathe

purposes as pressing, moulding and die casting, and the makers of such tools have to be highly skilled in the use of machine tools, but it would be idle to say that they can dispense with skill in the use of hand tools, however much machinery is available for their use.

Machine Saws

One of the most useful machines in the toolroom at the present day is the sawing machine in its various forms, such as the circular saw, the bandsaw, and the reciprocating or "jig" saw. From the aspect of rapid production, the two former types have the ascendancy; the circular saw principle has how been extended to the use of abrasive cutting machines, and the bandsaw to chain filing and abrasive band finishing machines. The latter group are perhaps the more useful because of their ability to deal with irregular shapes and not merely with straight cuts.

The jigsaw, though much slower than the other types by reason of its intermittent cutting action, is nevertheless an extremely useful, and sometimes almost indispensable, machine, especially on small work with abrupt changes of contour. In this case, also, the principle can be extended to filing and abrasive finishing, and the combined machine can be made in a simple and relatively inexpensive form. Such machines are now used extensively in many light industries for working wood, metal and plastics, and in a few cases are found also in the home workshops of model engineers. Where the financial resources and the workshop space available will allow, they will be found a valuable addition to the equipment of any model engineer; but most of us have to study economy in both respects, and in this event, there is much to be said for applying the working principle of the jigsaw in the form of an attachment to the ubiquitous model engineer's lathe.

Jigsaw Attachments

The idea of a lathe jigsaw attachment is, of course, quite an old one; many users of light woodworking lathes have adapted them to drive reciprocating saws, and there have been several commercially-made attachments, mostly for using fretsaws, put on the market in the past. This is an example of a device operating on the simplest basic principles, which any intelligent worker can contrive for himself; and where the operating conditions are not exacting, a comparatively primitive form of design will probably fulfil requirements. In many fretsawing machines and attachments, for instance, no special pains are taken to ensure that the saw moves in a truly rectilinear path; the ends of the saw are usually carried between the extremities of rocking beams, which move in an arc of large radius compared with the stroke of the saw, and the flexibility of the latter enables it to produce an approximately straight-line motion.

In cases where more rigid saws, or files, are used, however, it is necessary to support the tool blade more firmly, and also to avoid any deviation from a straight line, while the cutting of metal or plastics must necessarily demand a more rigid structure and higher precision of working parts than are called for in the simpler forms of fretsaw machines or attachments. Even so, however, an attachment capable of dealing with most model engineering requirements is not by any means a difficult or complicated thing to construct, and the machining processes involved are well within the capacity of the lathe on which it is intended to be used.

While no claims for originality in general principles or design are made in respect of the machine to be described, it contains a number of improvements and novel features in its details, and in common with other devices which have been described in the past for the benefit of the amateur constructor, the constructional processes have been carefully planned to suit the limited equipment usually available.

It may be mentioned that the design follows up the results of experience gained in the use of an earlier attachment, of a rough-and-ready nature, which was made in a hurry, to deal with a particular job, but proved quite serviceable, and worthy of having its general features perpetuated, with some minor improvements and tidying up, in the present design. The work for which this was required was for cutting out internal contours in sheet metal up to about $\frac{1}{8}$ in. thick, the curves of which were so abrupt that they could not be cut with any type of saw available except a fretsaw, and the slow cutting speed and fragility of the latter was a great disadvantage. It was, however, found that this job was one on which the popular modern tension file or "Abrafile" could be applied to advantage, and it proved to be so much more efficient and durable than a saw, even for straight or large-radius cuts, that it is strongly recommended as the "standard" cutting tool for this type of attachment. A simple adaptor was made to fit the two ends of the saw frame, the upper one being screwed to provide tension adjustment, enabling a 6 in. "Abrafile" blade to be held; these components are replaceable by fittings to take a fretsaw or miniature hacksaw blade, or the complete saw frame can be replaced by a holder for a sabre saw or a machine file if desired.

Constructional Materials

It is recommended that cast-iron or steel should be used for the main structural members of the attachment, with the exception of the saw frame or bow, which should be in aluminium alloy so as to keep its weight as low as possible while maintaining a sufficiently robust section of metal to ensure rigidity. Castings are desirable for the standard, swivel bracket, saw frame, connecting-rod, and the disc of the driving crank, though all these parts are capable of being fabricated if desired. The main sliding member may be made from a piece of rectangular bright mild-steel bar, which needs no machining, and the saw table may also be made from a piece of mild-steel plate, to save the trouble of machining the large surface area of a casting. Other steel parts are the cheeks and retaining plates of the slide, and, of course, the journal and pin of the driving crank, and the wrist pin in the slide plate.

The size of machine shown is suitable for fitting to a $3\frac{1}{2}$-in. lathe, and the height of the standard is arranged so that it can be mounted

on the cross-slide of most popular types of lathes of this size, though it is possible to adjust the working height of the slide to suit the lathe, by shifting the position of the wrist pin.

Principles of Construction

The general arrangement drawing does not show the driving crank, but it is obvious that this is driven by the lathe mandrel, and its journal may be held either in the self-centring chuck or in any other convenient way, such as by providing an adaptor to screw on the mandrel nose, or a taper shank to fit the mandrel socket. In the original "hook-up," an existing overhung crankshaft, made originally for a petrol engine, was employed; this, of course, gave a fixed stroke, and no particular need for stroke adjustment was found in using the attachment. As this may, however, be desirable in certain circumstances, it is provided for in the design of the crank disc which will be shown in detail later. Some attempt is also made to balance the weight of the slide and saw frame by a counterbalance weight on the crank disc, but perfect balance in a reciprocating mechanism of this nature is impossible, and the best that can be done is to balance out a part of the weight, in conjunction with making the working parts as light as possible consistent with strength. The attachment has been run at speeds as high as 700 strokes per minute without excessive vibration.

One of the practical difficulties in the design of a jigsaw attachment for the lathe is that very little vertical height is available to accommodate the reciprocating mechanism, in the space between the lathe axis and the bed. Some of the attachments, or even self-contained machines, which have been designed in the past have made use of slide cranks as a means of economising vertical space. These work fairly well, and their mechanical efficiency, although not very high, is probably good enough to cope with the relatively low cutting load usually encountered; but unless they are very well made and fitted, they are liable to become extremely noisy, and are often difficult to keep lubricated.

In the present design, it has been decided to use a short connecting-rod to convert the rotary motion of the crank to reciprocating motion of the slide. Although this rod is necessarily short, and sets up fairly heavy side thrusts on the slide as a result, the length of the guide surfaces on the latter is so large that they have good wearing qualities, and moreover, can readily be adjusted to take up side clearance when that becomes necessary. Both the sliding and rotating bearing surfaces will retain an oil film, and so long as normal working clearances are maintained, will work fairly silently for long periods.

The table of the attachment, which is mounted on an angle bracket with provision for swivelling adjustment, can thereby be tilted to any angle likely to be required in normal practice. It is, in any case, difficult to use such a device at excessively large angles of tilt, and in most pratical work, only slight tilting movement is sufficient. There may possibly be some grounds for criticism in the fact that the table tilts in the plane of the lathe axis, instead of in the cross plane as is more usual; but this has been done to keep the construction as simple as possible. It would have entailed a good deal more work in machining, and more complex operations, to have pivoted the bracket in any other way. In practice, it will be found just as easy to work at right angles to the normal plane when angular cutting is necessary, especially in view of the fact that the "Abrafile" will cut equally well in any direction. Note that the method adopted in mounting the swivelling bracket on the standard ensures that it pivots about a point coinciding with the top surface of the table, so that it is only necessary to provide a small hole in the latter, sufficient to clear the tool which is to be used, so long as it is well countersunk underneath.

(To be continued)

Yet Another Simple Dividing Device

by E.C.H.S.

To construct this device means rummaging around the scrap car dealers' yards to find a 120-tooth half time (distributor) wheel from one of the old, large high tension magnetos, probably of Bosch, Stuttgart, manufacture. A wheel with this number of teeth provides the following divisions, which cover most of the model engineers' needs. Any similar wheel will, of course, answer.

2-3-4-5-6-8-10-12-15-20-24-30-40-60-120.

The gear wheels are about $4\frac{1}{2}$ in. diameter by $\frac{3}{8}$ in. wide at teeth, made from a bronze casting, having a web about $\frac{1}{16}$ in. thick. Mount this truly in the chuck, machine away existing bearing boss in centre and open to a nice press fit on the lathe mandrel nose. Take light facing cuts front and back at the same setting, running out to a diameter just sufficient to clear the mandrel register flange. In use, this wheel is placed on the mandrel nose and locked in position by the chuck. It is not likely to move with the chuck tightened in the normal way, but if thought necessary, a register pin or key could be fitted.

Using this on a Myford M.L.7, a strip of $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. mild-steel with a small spacing block is fitted to tapped holes in front upright of headstock casting. On the mild-steel strip is carried a spring loaded detent having a tooth-shaped end to fit between the teeth of the gear wheel. If these parts are nicely made and fitted, the mandrel is locked quite rigid with no trace of back lash.

For use with Myford M.L.4 and similar lathes, a shaped bracket of $\frac{1}{8}$-in. mild-steel plate can be made to carry a detent and fitted to holes tapped at the top of the back gear guard, immediately above the mandrel nose.

Locomotive Efficiency

by Arty

THE first essential in considering the efficiency of a locomotive, or anything else for that matter, is to decide what you are actually interested in. For instance, the most " efficient " full-size loco, in the opinion of the railway authorities, might well be summed up as the one giving the maximum passenger miles per total cost !

However, the more customary technical meaning of efficiency as applied to machinery, and the work obtained therefrom, is surely brake-horse-power-hour/calorific value of the fuel supplied. That is, the work obtained from the machine compared with the potential energy put in. Again, the normal meaning of " efficiency " may be taken as the measure of a piece of apparatus to perform the job for which it is designed. A locomotive, full size or scale, is designed to produce power, used to haul itself and its load, at the expense of the fuel put into it. The more efficient examples will produce more power for the same quantity of fuel (expressed in terms of potential energy, i.e. calories or some similar unit).

Let us examine this concept of b.h.p.-hour/energy supplied, as a measure of locomotive efficiency more closely, thereby clarifying certain practical points and correcting some erroneous views popularly held.

The power exerted by the locomotive must be measured. It is very bad practice to estimate this by considering the load that is being hauled on a train, that is, by considering the weight of the trucks, passengers, static loads, etc. The locomotive power is utilised to drag this load along the track, not to support it in mid-air ! That is, the rails support the train, while the energy developed by the locomotive is employed, under constant speed conditions on level straight track, in overcoming the reluctance of the train to continue moving, which drag is chiefly composed of the friction in the bearings, the friction of the wheel flanges on the rails, etc. All of these can vary considerably with the same train load, the bearings may be plain or rolling, they may be dry, recently oiled or greased, the passenger " load " may be sitting on the side of the truck so that the wheel flanges are rubbing on the rail, etc. Thus, the assumption that the train load necessarily reflects the drag on the engine and hence its power, is quite erroneous. It is also a dangerous assumption, even for comparative trials with several locomotives, that all will be well if the same train and dead load is used throughout.

For measurements of locomotive power output or efficiency it is essential to measure the power directly. To do this, the drawbar pull and the speed must be determined. There should be no great difficulties involved in measuring either, the first with a calibrated spring, possibly with a dashpot to damp vibrations, between the locomotive and the train ; the second by timing the train with a stop-watch over a suitable distance. If this procedure is followed, it does not matter if the line is level (within reason, obviously the locomotive would be exerting little power if the train was over-running the locomotive down a gradient !) and brakes can be used (on the train *only*) to artificially increase the load.

Regarding the fuel, it is not really satisfactory to use the weight or the volume except for comparative trials where everyone is using the same fuel, and even then only if the quality is very consistent.

The great advantage of the b.h.p.-hour/calories concept is that any locomotive performance can be compared with any other, without regard to the conditions existing at the time of the trial. It is, however, essential to convert the weight of fuel used into, say, calories, the actual amount of energy latent in that fuel.

Some authorities seem to think that allowances should be made for the scale of a locomotive. Of course, a small scale locomotive is more susceptible to such things as tight gland packings, etc., and these things will have a proportionately greater effect. But this is an internal matter, any such internal losses decrease the efficiency of the locomotive and should be taken into account in assessing the efficiency. The efficiency of one gauge locomotive cannot be fairly compared with that of another, smaller gauge locomotives suffer from some disadvantage in that respect, which in inherent to the smaller scale.

Some formulae have been suggested for comparative trials. One is as follows :—

$$\frac{\text{No. of laps} \times \text{Load}}{\text{Theoretical T.E.} \times \text{Fuel}}$$

The use of the train load is liable to introduce errors (even for comparative trials), as suggested earlier, and is to be deprecated. The inclusion of the theoretical tractive effort is an attempt to put various size locomotives on an even footing. This is not necessary and this term merely confuses the whole issue. A smaller locomotive, while hauling a smaller load for a shorter distance, will also only require a smaller quantity of fuel. The formula, without this term, is already compensated so that locomotives of various sizes can be fairly compared (except for the inherently greater effect of internal losses—" Nature cannot be scaled ").

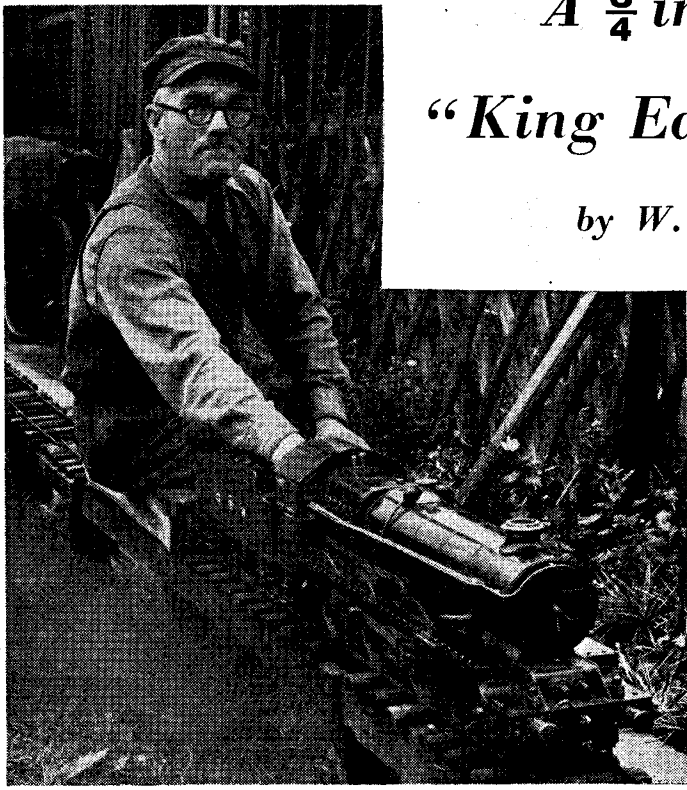
The fallacy of adding the theoretical tractive effort term can be illustrated by considering two locomotives identical except for one, *A*, having a cylinder diameter twice that of the other, *B*. *A*'s theoretical tractive effort will then be four times that of *B*. Put them on the road and what happens ? *A* can haul a much heavier load (assuming that it doesn't slip), but only for a short distance. However, the product of No. of laps times load and the total fuel consumption is probably much the same (although used at a greater rate), therefore not changing the value of the product :—

$$\frac{\text{No of laps} \times \text{Load}}{\text{Fuel}}$$

(*Continued on page* 620)

A ¾ in. Scale "King Edward VII"

by W. J. Smith



THE photographs reproduced herewith show my second attempt at locomotive building. I have always had a soft spot for G.W.R. "Kings" and this is the result, a ¾-in. scale *King Edward VII.*

Castings and drawings were supplied by Jackson, of York. ⅛-in. by 3-in. mild steel was used for the frames to which the horns and boxes were fitted. The leading coupled axle was fabricated, and consists of four crank webs, two crankpins and the axle in three pieces. The centre portion of the axle carries the two eccentrics for the inside Walschaerts gear. On application to Mr. Hawkesworth, C.M.E. of the G.W.R. works, he kindly supplied a drawing from which I was able to set my eccentrics and so obtain equal port opening on all four cylinders. The wheels are fitted with balance-weights, cut out from 16-gauge mild-steel plate and fixed to the wheels with 6-B.A. bolts.

The cylinders were bored by mounting them on a piece of 2-in. angle bolted to the faceplate and bored to within 2 thous. of an inch. To obtain a finish similar to glass, I wrapped a piece of superfine blue-back round a wooden mandrel. The lathe was treadled at a very fast rate and the cylinder slid backwards and forwards along the mandrel. The pistons have the usual hemp packing-ring

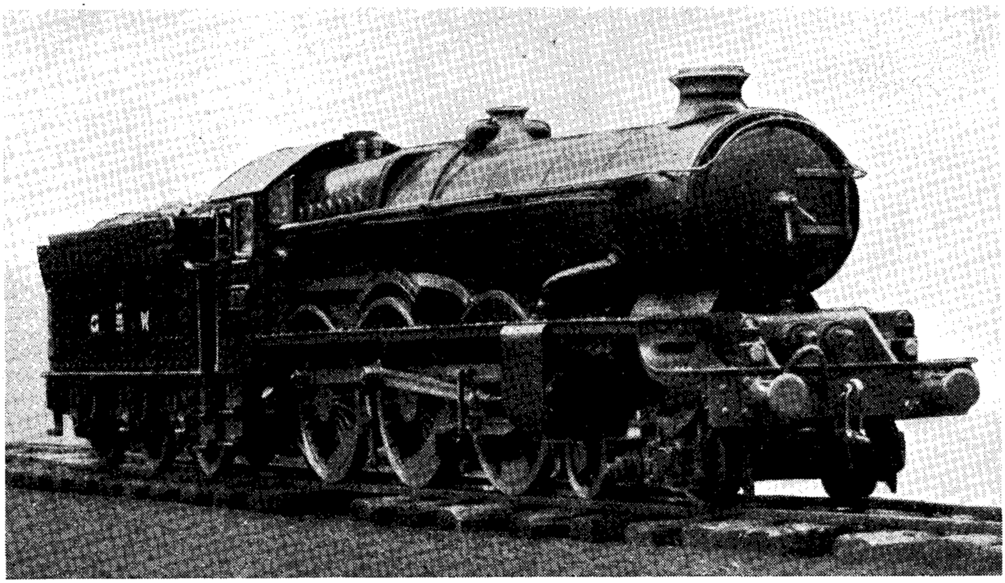
Rods and motion work were all cut by hand from mild-steel plate as I have no milling machine. I did manage to flute the donnecting-rods by bolting them on the cross-slide and traversing them across a $\frac{3}{16}$-in. end-mill, setting them up twice to obtain the length of the flute.

The boiler came next. For this, I obtained a piece of 13-gauge soft rolled copper sheet, 2 ft. square, which was sufficient to cut the barrel, wrapper, inner firebox and three girder stays. The piece for the barrel was bent round a piece of 4-in. drain-pipe and joined with a ⅛-in. by 1-in. butt strip, riveted and silver-soldered. The butt strip was joined on the outside in order to leave more water space under the bottom row of tubes, of which there are 16. These are $\frac{7}{16}$ in. diameter by 18-gauge. Here also are the two ¾-in. flue tubes which carry the superheaters and the throttle tube, which means that little space is left for the water. This accounts for the fast steaming of the G.W.R. boilers.

The throttle is a disc-in-a-tube with a collecting pipe just under the small plug on the wrapper; a few drops of cylinder oil through this hole keep the throttle lubricated. The two superheaters are connected to a small header ⅝ in. in. diameter by 3 in. long, lying crossways in the smokebox. Steam is then fed to the four cylinders by ¼-in. copper pipes. When finished the boiler was given a jacket of $\frac{1}{16}$-in. fibre asbestos packing which was, in turn, lagged with 26-gauge lead-coated iron, held in place by four straps.

What with 2 ft. square of copper, 20 tubes, 10-gauge tube-plate and back-head, girder stays, plenty of silver-solder, lagging and fittings, the whole is fairly heavy. I must mention the fact that our local plumber helped me with the brazing, with his gas outfit.

The smokebox was rolled up from 16-gauge mild-steel and was riveted along the bottom. A piece of 10-gauge mild-steel plate was used to make the door and turned to shape.



The tender is made to the real G.W.R. pattern, 16-gauge soleplate, 22-gauge sides, and contains the usual panel-pump and four pipes for the auxiliaries. At first, I thought that I had too many rivets in it, but after seeing Mr. Cottam's G.W. tender at the 1948 MODEL ENGINEER Exhibition, I found that I was a few hundred short! The engine and tender are painted in Bond's G.W. green, and I think she looks very well.

In conclusion, all the machining was accomplished on a very old 3-in. Zyto treadle lathe and the drilling was done on a two-speed hand-drill. I would like to thank Mr. Jackson for his assistance and good castings, and also "L.B.S.C." for his articles on locomotive building.

Locomotive Efficiency

(*Continued from page* 618)

The inclusion of the term theoretical tractive effort is clearly unfair.

Another formula that has been suggested is :—

$$\frac{\text{Actual distance} \times \text{Load} \times \text{Ratio of distances}}{\text{Basic distance} \times \text{Fuel} \times \text{Time}}$$

Now this quantity so quaintly termed "ratio of distances" is apparently the actual distance divided by the basic distance, where the basic distance is some arbitrarily fixed distance. If this is substituted in the formula, it reduces to :—

$$\frac{\text{Actual distance}^2 \times \text{load}}{\text{Basic distance}^2 \times \text{fuel} \times \text{time}}$$

This formula can be further reduced to :—

$$\frac{\text{Actual distance} \times \text{load} \times \text{speed}}{\text{Basic distance}^2 \times \text{fuel}}$$

which is actually a power, or a rate of doing work, divided by a quantity of energy. The arbitrary term "basic distance^2," being constant, will not affect this consideration of the units involved. This formula therefore lacks a time term on the top line to convert the rate of doing work into the actual amount of work supplied and which is necessary to compare it with the given amount of fuel, which represents the amount of latent energy available.

The question of whether it is permissible to aid the locomotive's adhesion while under tests of this nature rather depends on one's definition of efficiency. Even with the criterion of work produced over work put in, it depends on one's personal ideas. Supposing a locomotive does slip under test, it means that the combination of conditions at the wheel and rail surface are such as to be incapable of transmitting the power produced by the locomotive. Is that the fault of the locomotive, whose efficiency you are determining, or of the rails, whose efficiency you are not interested in? Your answer to that will decide whether you consider it reputable practice to assist the locomotive's adhesion properties. Obviously, it would not be fair to test the locomotive on greased or oiled rails, to go to the extreme; but on the other hand, one does expect a locomotive to exhibit reasonable adhesion to the rails. On the balance, I personally would say that it is fair to assist the locomotive's adhesion if it slips—one is mainly interested at this stage in the power it can produce, not whether that power can be transmitted through the junction of wheel and rail. Finally, of course, one can compare to full size practice where the crew assist the locomotive's adhesion whenever it is necessary.

It is hoped that these few notes on the subject of locomotive efficiency have helped readers and will possibly serve to provoke some useful discussion on the subject.

*The Elements of Maintenance

for 10-c.c. Racing Engines

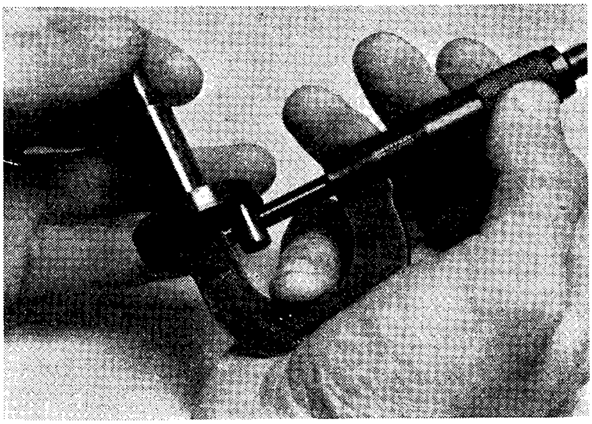
by G. W. Arthur-Brand

As mentioned last week, my aim in this issue will be to show you how best to inspect and check the component parts of your engine, in exactly the same way that full-sized engines are checked and inspected between meetings.

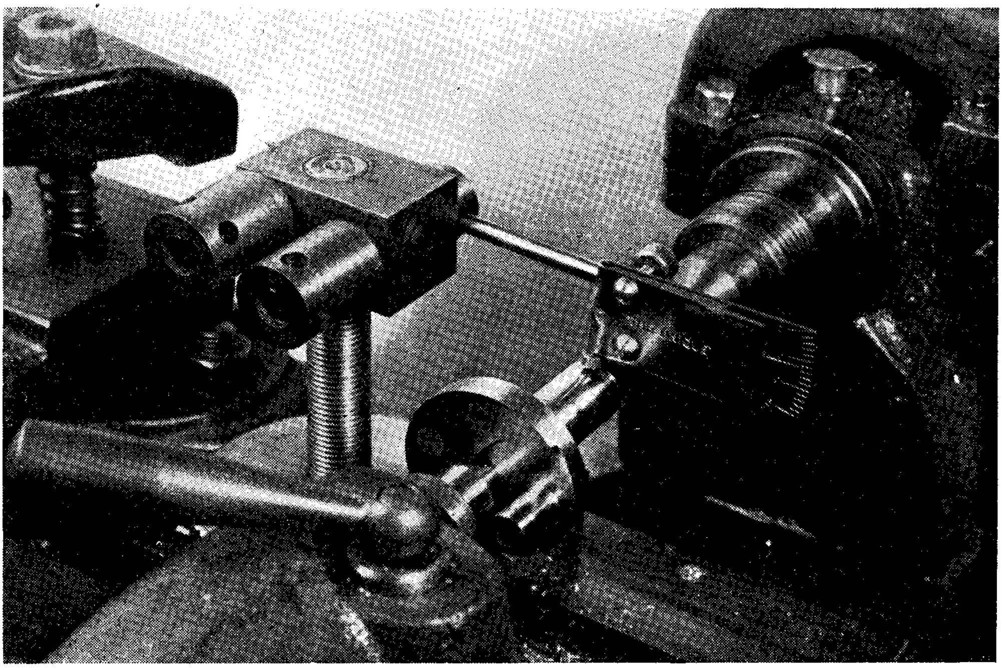
Many miniature enthusiasts argue that "that's O.K. for big stuff, but no good for our purposes." My reply? Rubbish! If the "know-alls" of our miniature racing world would only pull their socks up and accept facts instead of beating around the bush, they might progress farther along the road of rapidity.

In writing these notes, it has been my aim to make observations and suggestions applicable to the maintenance, overhaul and tuning of

**Continued from page 604 "M.E.," April 27, 1950.*



Checking wear on crankpin with micrometer.



Checking crankshaft between lathe centres.

high compression *racing* engines of the large-port rotary induction type and I, therefore, assume that those of you who contemplate putting these suggestions into practice are after maximum speeds and optimum performance. I feel, therefore, that I must issue the same warning as is issued to the drivers of all highly-tuned, full-sized units: you cannot create records and remain on top without risk of a certain amount of expense due to mechanical failure of one sort or another. In other words, and rather unfortunately, it is usually the chap who can afford to blow up his engine who gets the best results! If you cannot afford such risks, you must be content not to tune your motor so finely and to resist the temptation to weaken your mixture to "screaming" point until the motor has been well run in. As a heartener, however, I might add that, whereas he might never do as well from the point of view of actual m.p.h., there will be times when the not-so-hot man will entirely steal the day by virtue of greater reliability in all-round performance.

Method of feeling the races in order to determine internal condition.

To continue now from where we left off last week, I am going to assume that your engine has been dismantled and that all parts have been placed in their respective envelopes.

Let us start with the crankshaft, the most expensive and susceptible component. This part should be handled very carefully and every effort made to ensure that it is not dropped, or in any way scarred by contact with other parts. First remove, with a clean rag dipped in petrol, any grease or oil adhering to it. Next, with a 0-1 in. micrometer, go very carefully over both journal and crankpin, rotating after each reading, in order to make sure that no undue wear has taken place. Note the way the component is held, by the threaded portion of the journal and the web. This is in order to obviate the possibility of expansion due to overhandling; the same, incidentally, applies to the micrometer, which should on no account be held with any part of the hand making contact with the anvil or spindle faces.

Having satisfied yourself that the component is either (a) satisfactory, there being no ovality or other diametric distortion; or (b) overworked and U/S, you now take one or other of these courses: (a) proceed to the lathe, support between centres and check for longitudinal truth or bend, or (b) throw it away and buy another!

Let us be optimistic and assume that the crankshaft (both journal and pin), is satisfactory, both as regards to concentricity and straightness (no limits should be allowed here): we can then turn our attentions to the front crankcase cover, which houses the crankshaft bearings. In most racing engines these will take the form of ball-races and if a good season's racing has gone by, it is very probable that a certain amount of grit will have found its way in among the balls. This may be checked in the manner shown, after which a syringeful of petrol well directed will usually be found to do the trick. Continue to use the syringe until all grit has been removed, then oil lightly and seal off, using either adhesive tape or greaseproof paper, or both. Should either of the races appear in the least bit strained or damaged, it should be carefully extracted and a new one fitted. Here again the utmost care is required, as the two must be in perfect alignment if results are to be 100 per cent. satisfactory.

(To be continued)

"Reliance" Tools

WE have recently received a very interesting catalogue from Messrs. H. D. Murray Ltd., of 17-21, Queensway, Ponders End, Middlesex, which lists a number of items which, we feel sure, would be of considerable interest to model engineers.

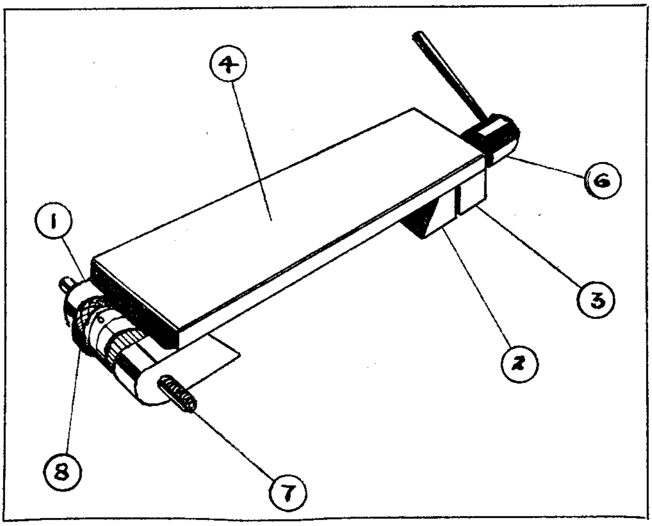
Picked at random, there are a number of chucks of various patterns at competitive prices and of various sizes from 0-½ in.; "Reliance" B.A. socket sets in black oxidised finish with double-end wrench and long-reach handle; "Reliance" thread restorers (thread files) for restoring battered threads on bolts, studs and pipes; best quality cast-steel lathe centres from No 0-No. 4. Morse taper, milling arbor spacing collars and distance-pieces, hardened and ground all over with keyways, and the "Reliance" drill grinding jig, a piece of equipment which will produce first class results in the absolute minimum of time.

It would appear from the quoted specifications that all these appliances are of the very highest quality and readers may care to avail themselves of this very useful catalogue, wherein full details and prices are given.

A Micrometer Stop for the Lathe Saddle

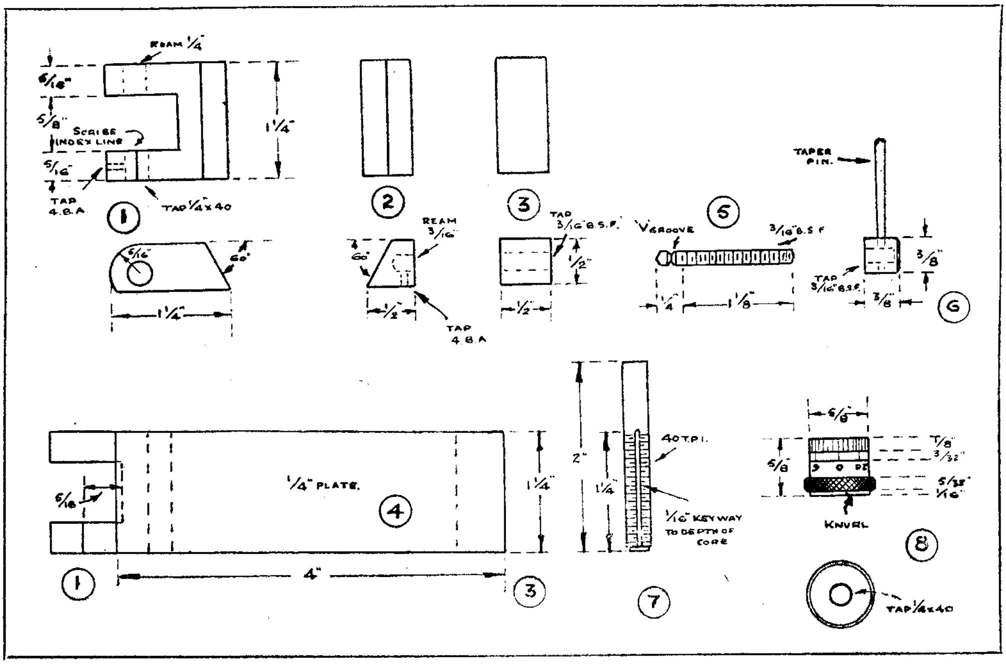
by R.H.C.

DURING milling operations with work bolted on the boring table, angle plate or vertical slide, it is often useful to have some means of providing a micrometer feed to the saddle. This may, of course, be accomplished by the fitting of an index collar to the lead-screw, but after careful consideration, it was decided that the attachment described would fulfil the same purpose and at the same time have several additional advantages.



I have not previously seen this type of attachment used on an English lathe, although I believe there is a similar stop provided as an accessory to the American "Atlas." The dimensions of the stop described are for the Myford M.L.4, although it could, I think, be adapted to fit almost any type of lathe, except, possibly, the raised "V" bed type. It may be used either in front of or behind the saddle for providing a micrometer feed, or used merely as a positive stop for locking the saddle, or set at a predetermined distance when working up to a shoulder, etc., or during facing operations.

Since constructing this stop I have decided that its use could be extended to an adjustable stop for the cross-slide, by bolting a suitable pillar to the top-plate tapped to take a screw with lock-nut, which could engage with a stop fitted in the "T"



slots of the boring table, this could then be set to operate when feeding in or reversed for working from the back tool-post, etc., and possibly other uses will suggest themselves to readers.

The construction will be found quite simple, the chief items of material required being a piece of $\frac{1}{4}$-in. B.M.S. plate, $1\frac{1}{4}$ in. × 4 in., some pieces of $\frac{1}{2}$ in. × $1\frac{1}{4}$ in. B.M.S., and the usual odds and ends to be found in most workshops.

Parts 1 and 2, may be formed with hacksaw and file or milled as desired; 1, 3 and 4 are pinned and silver-soldered together. The index thimble, 8, should be turned, drilled, tapped and the divisions cut with tool on side in toolpost using 25-tooth changewheel on mandrel with indent for indexing. The knurling was put on with the tool described by "Duplex," in one of their early articles, this I consider is one of the most useful tools I have made. The thimble is then parted off a few thou. over length and finally faced off a close fit in the fork of Part 1, to avoid backlash.

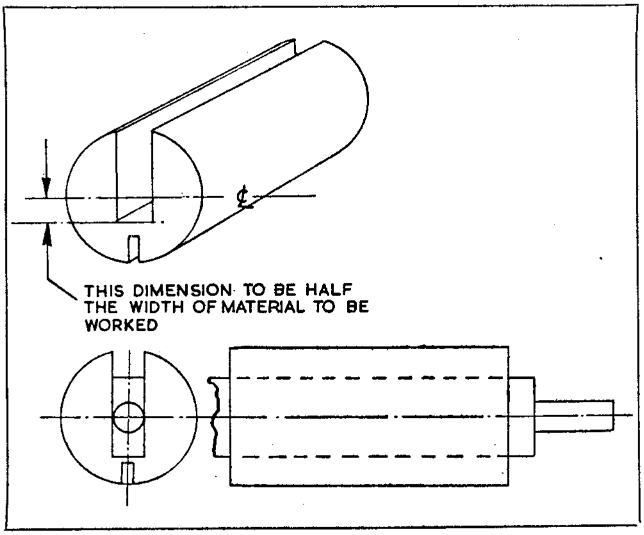
The keyway in the screw 7, can be cut with a Woodruff-type cutter or end-milled. After fabrication of parts 1, 3 and 4, the loose clamping-piece 2, should be held against 3, with a tool-maker's clamp and $\frac{3}{16}$ in. B.S.F. tapping drill put right through 3, into 2, after which hole in 2 should be opened out and reamed, $\frac{3}{16}$ in. On assembly, the clamping-screw 5, should be screwed through 3, the pad 2, is then slipped on to the unthreaded end of 5, and a "V"-pointed set-screw inserted in 2, to engage in the groove formed on the end of 5. The knob 6 may then be screwed on to 5, cross drilled and reamed, for the taper pin which is used for the clamping handle.

Chucking Rectangular Bars

by W.D.C.

MOST model engineers are frequently faced with the task of turning plain and screwed ends on flat or square section materials when making up such model components as brake stretchers, fork-ends and other similar articles. Whilst these are quite simple to produce, they can take up a fair amount of time, which could be used to greater advantage if the job were simplified, particularly in the setting of the material in the chuck. If the tools described below are made as required, to suit the regularly used sizes of material, it will be found that they will prove their worth and will last for years.

The only requirements are a few short ends of round bright mild-steel of about $\frac{5}{8}$ in., $\frac{3}{8}$ in. and $\frac{7}{8}$ in. diameter. These are cut off about $1\frac{1}{2}$ to 2 in. long, and a groove milled or shaped along them as shown in the sketch, the depth being determined by the job. Along the opposite side they should have a saw cut made to within about $\frac{1}{16}$ in. from the bottom of the first groove.



The method of use is simple; all that is required is that the material to be worked upon be placed in the groove, protruding just sufficiently to make the length of end required and no more. The whole lot is then put into the jaws of a self-centring chuck, the groove midway between two of the jaws. On tightening the chuck, it will be found that the material is held firmly.

If the groove has been cut accurately, a true pin can be turned as simply and as quickly as it can be done on round material.

IN THE WORKSHOP

by "Duplex"

62—Compressed Air Supply for the Workshop

A SUPPLY of compressed air is essential if many of the processes in workshop practice are to be carried out satisfactorily. Brazing, hardening and paint-spraying all need compressed air, so that, when equipping a workshop, a supply should certainly be considered.

For those who need air only for light brazing and open-hearth case-hardening, a low-pressure air supply will be found quite sufficient. A suitable blower, which will deliver air at a pressure up to 5 lb. per sq. in., is illustrated in Fig. 1. The design for this device appeared in THE MODEL ENGINEER for September 2nd, 1943, and was described by Mr. H. Lloyd. It has the merit of simplicity; it is robust and requires no castings; to this may be added silence in operation, an undoubted asset.

As will be seen from the illustration, the blower has a circular casing in which runs an eccentrically mounted rotor carrying vanes which are free to move in slots machined in it. Inlet and delivery ports are formed in the casing and, in the original design, pipes are screwed in to these, one carrying the intake silencer, the other pipe leading to the air-vessel. The bearings for the rotor shaft, which is overhung, are fitted in one end-cover, and are spaced so that an oil well is formed between them. The upper surface of the extension which houses the bearing bushes is slotted and is provided with a spring-on cover to the oil well. A bronze ring, slipped over the rotor shaft and running in the well, lubricates the bearings. The blower itself is mounted on angle-iron feet shaped to conform to the outline of the casing, four of the screws holding the end-covers performing the additional duty of securing the feet.

In any rotary blower of the sliding vane type, the lubrication of the rotor and vanes is a most important matter, for upon this depends the efficiency of the machine and its length of life. In this instance, the oiling arrangements are entirely automatic. As will be seen from Fig. 2, which shows, in diagrammatic form, the general arrangement of the blower and air-vessel, the latter contains a small quantity of thin oil into which dips a pipe connected to the air intake. When the blower is running, the pressure of air in the vessel forces the oil up the pipe into the blower intake, whence it passes directly into the blower casing. After lubricating the working parts, the oil is then discharged as a fine mist with the compressed air, and returns to the air vessel by way of the delivery pipe.

It will be obvious that the oil in circulation must not exceed an amount required for proper lubrication, otherwise the surplus may be carried over into the air hose and into the apparatus in use, to the detriment of both. In the original design, a small gas tap was used to regulate the

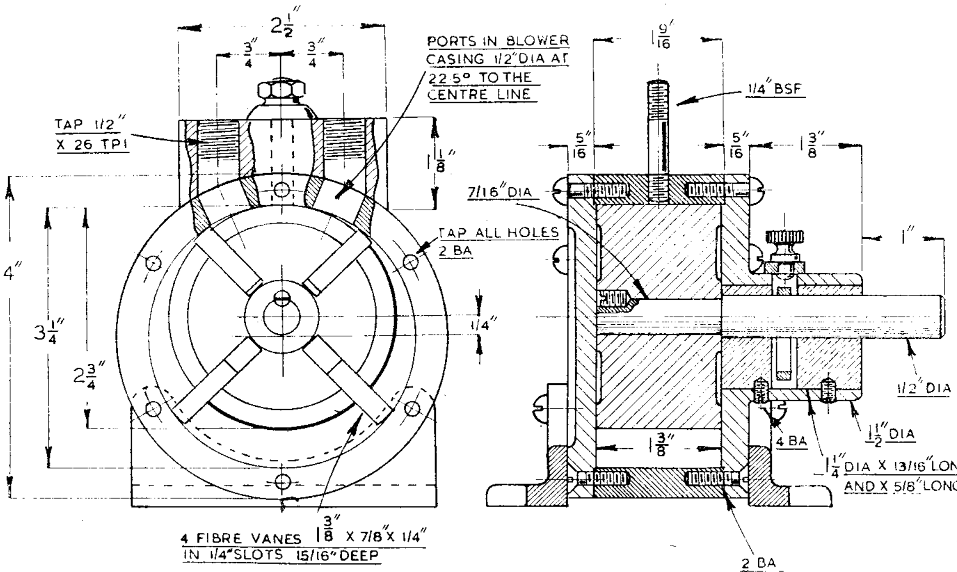


Fig. 1. General arrangement of the blower

oil supply, but, in the example we made for our workshop, this, together with some other small details, was modified. The holes drilled in the vertical air-pipe ensure that, under normal conditions, the air delivered is free from oil mist, for by this means the speed of the incoming air is slowed down and this allows the oil to fall out of suspension and collect in the base of the air-vessel.

Modifications to the Original Design

The blower, as made by ourselves, conforms generally to the original design, but the following points have been modified.

(1) The outer main bearing-bush has been lengthened by $\frac{3}{8}$ in. to provide more support for the rotor shaft.

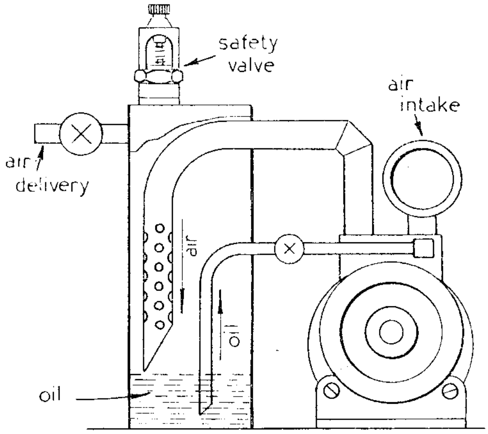


Fig. 2. Diagrammatic drawing of blower and air vessel

(2) The material of which the bearing bushes are now made is cast-iron, for which we have a personal preference, as it allows the shaft and its bearings to be fitted very accurately when both components are lapped as a final operation.

(3) The rotor now has four vanes instead of two.

(4) The end-covers are secured to the casing by six screws on each side instead of four as originally shown.

(5) Instead of the two screwed pipes for air intake and delivery, a saddle-piece has been fitted to the top of the blower casing. Into this saddle, which is secured to the top of the casing by a single $\frac{1}{4}$-in. B.S.F. stud, with a nut and washer, are screwed the intake silencer, the air delivery pipe to the air-vessel and the oil feed pipe union. These modifications may be seen in greater detail if reference is made to Fig. 3.

(6) Regulation of the oil feed has been modified by the fitting of a Best & Lloyd sight feed. This allows the oil supply to be adjusted and checked visually whilst the blower is running. This addition can be seen in Fig. 4 which shows the complete apparatus.

The Air Vessel

This can be made from any suitable container, since it is only required to withstand light pressures; indeed, the original design made use of a standard one-quart oil can, at one time supplied by oil companies selling motor lubricants. The air-vessel shown in the illustrations is made from a length of 16-gauge seamless drawn brass tubing, and has end-caps machined from brass blanks sweated into it. These blanks are shouldered and are made a firm fit in the tube. All connecting unions are nutted to the inside and soft-soldered before the end-pieces are fixed.

The Safety-valve

This may be seen in Fig. 4 and in detail in Fig. 5, where it will be observed that the body of the valve is machined from a piece of hexagon brass rod, and has a cap, threaded $\frac{5}{16}$ in. by 40 t.p.i. for the adjusting screw, pressed into its outer end.

The valve itself is of the flat-faced form having a $\frac{3}{16}$ in. diameter spigot machined on its underside for guidance. Six holes, 7/64 in. diameter on a $\frac{7}{16}$ in. diameter pitch circle, admit air pressure to the face of the valve, which is held down to its seating by a light coil spring $\frac{5}{16}$ in. diameter having six turns of No. 23 s.w.g. wire.

The body of the safety-valve serves also as the filler cap by means of which oil is introduced into the air vessel. The latter has a nipple, threaded $\frac{3}{4}$ in. $\times$ 20 t.p.i. to accommodate the valve body. The threads on both components were cut in the lathe.

Machining Parts for the Blower

The machining of the blower components is quite straightforward and we do not propose, therefore, to describe in detail all the operations which are necessary. There are, however, certain points which call for some comment, and at the outset it must be emphasised that, in order to ensure that the rotor runs clear in the casing with the minimum of radial and lateral clearance, the workmanship must be accurate.

The Casing

The casing is made from a short piece of heavy gauge steel tubing, 4 in. diameter, or from steel bar, should tube be unobtainable. It is first machined to an internal diameter of $3\frac{1}{4}$ in. and has one of its ends faced. Both operations are carried out in a four-jaw independent chuck, the material being set to run true on its periphery by means of a test indicator. After boring and facing, the inside is polished as highly as possible, and the corner of the casing is given a slight chamfer to avoid interference with the shouldering of the end-cover. It should be noted that the depths of these shoulders is only $\frac{1}{16}$ in., therefore the chamfering must be no more than a breaking of the corner, or the location of the end-cover will be lost.

The casing is now reversed in the chuck, and again set to run true; at the same time a check is made with a feeler gauge, applied at the point of contact between the face of the chuck and the casing, to ensure that the casing makes perfect abutment. The outer face is now mach-

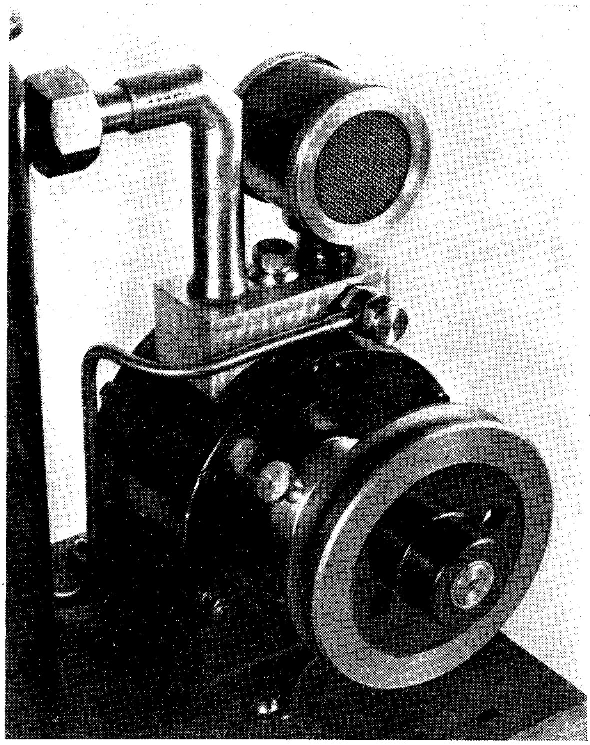


Fig. 3. The blower, showing saddle and oil feed pipe connections

ined and the width of the component reduced to $1\frac{9}{16}$ in. exactly.

End Covers

It is advisable to make the two end covers next. These are made from 4 in. round bar, and preferably of duralumin of which material there appear to be plenty of off-cuts obtainable. The most important operation is the machining of the spigots or shoulders which locate the covers in the bore of the casing. The driving side cover should be made first, commencing by setting a piece of suitable material to run true in the four-jaw chuck, after which the extension to house the bearing bushes may be turned to the diameter and length shown on the drawing. The part is now reversed in the chuck, and set to run true held by the extension. The cover is then faced so that the thickness is reduced to $\frac{5}{8}$ in. exactly. A right-hand knife tool, set in the top-slide should be used for both this operation and the machining of the spigot which follows. Before attempting to machine the shoulders, the finished bore of the casing must be accurately measured, either with an inside micrometer or by means of calipers and an outside micrometer.

When this dimension has been found, a facing cut of 0.020 in. is taken, the tool being fed in to a depth which will leave the spigot some 0.010 in. oversize. A note is made of the cross-slide index reading, after which the remaining 0.042 in. of metal is removed from the face of the shoulder in two or more cuts, the tool being fed inwards until the cross-slide reading is the same as that previously noted.

The reading of the leadscrew index must now be taken and noted, so that, when turning the spigot to its final diameter, the tool is not allowed to cut into the shoulder. The spigot should not be finished in one cut, but left some 0.003 in. oversize. The casing can then be tried on the spigot, and the remaining metal removed, 0.001 in. or less per cut, until the two parts fit perfectly. When this operation has been completed the cover can be bored to receive the bearing bushes.

The second end-cover is treated in exactly the same way, but is held by its periphery for the recessing of the outer face, being first set to run true by means of a test indicator.

It should be observed that the depth of the shoulders must be measured exactly either with a vernier, or a micrometer depth gauge, to ensure that the spigot is precisely 0.062 in.

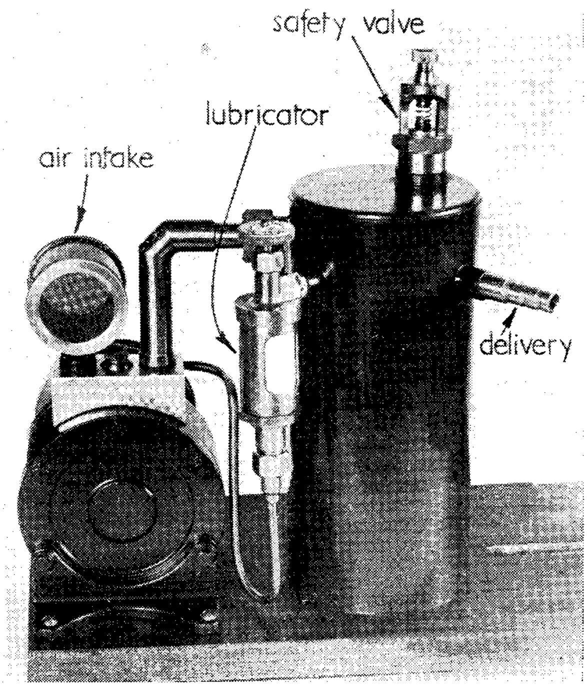


Fig. 4. The complete blowing apparatus

deep, thus leaving a distance of $1\frac{3}{8}$ in. plus 0.001 in. between the inner faces of the covers when they are screwed to the casing.

Bearing Bushes

The bushes are next made to the dimensions shown in the drawing, Fig. 1. They should be a press fit in the cover plate extension, but must not be bored to receive the shaft at this stage. An interference fit of 0.001 in. will be found sufficient, for the bushes are subsequently secured by 4-B.A. set-screws as shown in the drawing.

After pressing in and securing the bushes, the boring centres must next be marked-off. To do this, the end-cover is clamped to an angle-plate,

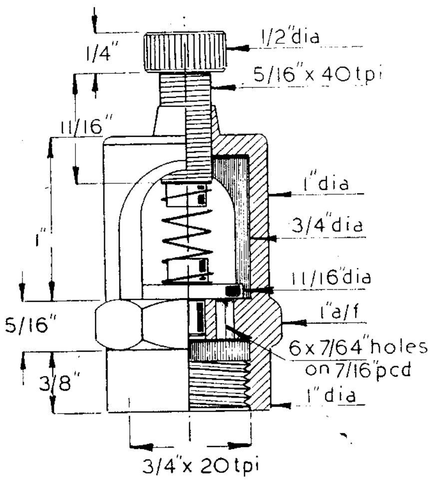


Fig. 5. Details of the safety-valve

set on the surface table, and two centre-lines at right-angles to one another are scribed on the face of the outer bush. From the drawing it will have been seen that the bores of the two bushes are eccentric to the centre-line of the cover itself, and that this eccentricity is $\frac{1}{4}$ in. The angle plate is, therefore, turned at right-angles, the point of the scriber on the surface gauge raised $\frac{1}{4}$ in. from its original setting, and a line is scribed across the vertical centre-line. The intersection of these two lines is the centre for boring the bushes, and is lightly centre-punched and centre-drilled to receive the point of the centre-finder or wobbler, the use of which has already been described in these pages. For the boring operation, the end-cover is clamped, extension outwards, to the lathe faceplate. This method of mounting will ensure that the finished bores are truly at right-angles to the inner face of the cover. After the bearing centre has been set truly to run by means of the centre-finder, the bores may be machined, leaving them 0.001 in. undersize as an allowance for lapping.

The rotor must first be left oversize both on diameter and on width, for it will finally be turned between centres on its own shaft. The rotor is a press fit on the shaft; these parts are subsequently locked together by a sunk grub-screw, tapped axially, half in the rotor and half in the shaft, as seen in Fig. 1. When the two components have been secured, final turning of the rotor may be carried out, first reducing the width to allow end-float of 0.002 in. in the casing. An additional clearance of 0.001 in. is required at the rim, thus making the sum clearance over the inner faces of the end-covers at this point 0.002 in. Before the rotor is pressed on to the shaft the $\frac{1}{2}$ in. diameter portion of the latter is lapped. A piece of brass sheet should, however, be interposed between the lathe carrier and the work to prevent damage to the finished surface.

It will not be out of place, at this point, to describe the method used for mounting the driving pulley. Reference to Fig. 3 will show that the bore of the pulley is larger than the diameter of the shaft, and that a well-fitting, turned and split bush has been slipped over the shaft. It is upon this bush, which is made of brass, that the pulley itself seats. A set-screw in the pulley compresses the bush which grips the shaft, thus securing the three component parts of the device, and preventing damage to the highly finished surface of the shaft. This method of preventing shafts being damaged by pulley fixings has much to recommend it, and is very suitable when only moderate power has to be transmitted. The details of the arrangement are shown in Fig. 6 and it will be clear that the bush must be a good fit or the pulley will be thrown out of truth. The bush should be a firm push fit on the shaft and a light push fit in the pulley so that it cannot be displaced whilst the latter is being mounted in position.

The machining of the periphery of the rotor to its final diameter needs care, for it must clear the inside of the case by 0.002 in. to 0.003 in. only. As the rotor is being turned on its own shaft between centres it is possible to carry out the final stage of the fitting operation by a process of trial and error, noting the cross-slide index reading after each cut. It will, however, first be necessary to find exactly how much must be removed from the rotor to allow it to enter the casing. Accordingly, a piece of $\frac{1}{2}$-in. diameter round, centreless ground bar is passed through the bearings, and a measurement is taken from this test bar to the inside of the blower casing by means of calipers, as shown in Fig. 7. This measurement is then transferred to a micrometer, the reading of which must be noted. For purposes of explanation it may be assumed that this reading is 1.127 in. If half the diameter of the test bar, that is 0.250 in. is added to this figure, the actual distance between the shaft centre-line and the inside of the casing will have been found, the dimension in this example being 1.377 in. Multiplying this figure by two the required diameter of the rotor is found, that is to say 2.754 in., and, if turned to this measurement, the rotor should just enter the casing.

If the oversize rotor is now measured, the amount needed to reduce its diameter to 2.754 in. will be evident.

It might be considered better, at this stage, to machine the rotor to its finished size at once rather than resort to trial and error methods for the final turning operation. Experience has

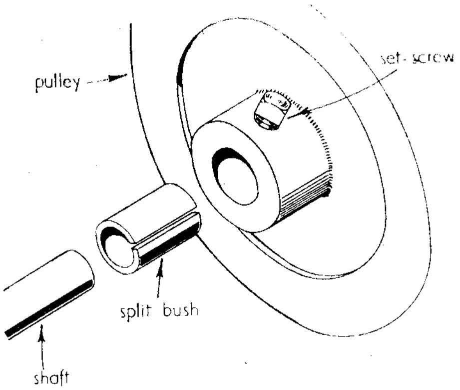


Fig. 6

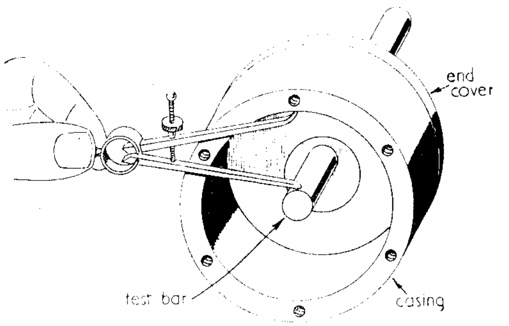


Fig. 7. *Measuring the casing to obtain the rotor diameter*

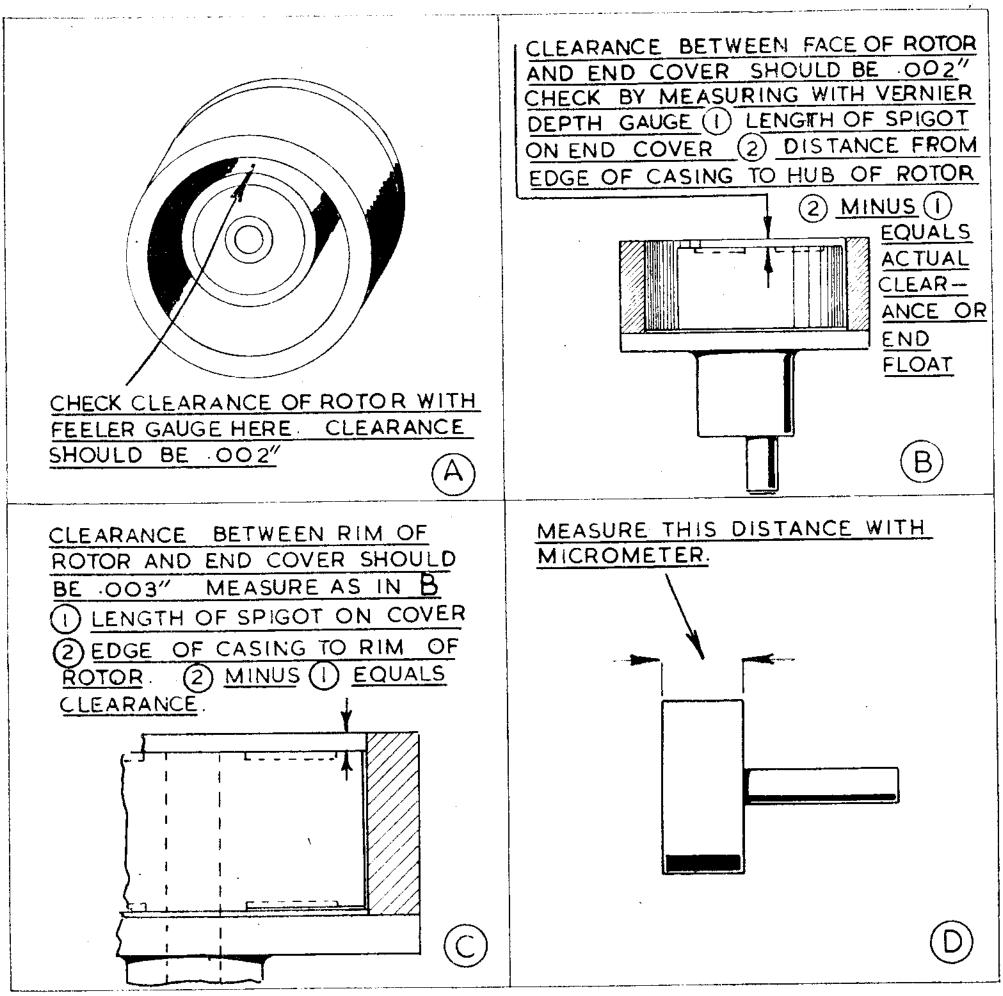


Fig. 8. *Checking the rotor and casing*

shown, however, that it is safer to adopt the method advocated in case there may be some small discrepancy in the initial measurement taken with the calipers and test bar. Some workers are capable, in this way, of making very accurate measurements, whilst others, perhaps with less practice, do not seem able to do so. It is for this reason, therefore, that a trial and error method is recommended.

The diametrical or peripheral clearance of the rotor is checked by means of a feeler gauge, as shown in Fig. 8A. The amount of end-float can be assessed by passing the rotor into the casing, to which the driving side end-cover has been secured, and measuring directly, with a micrometer or a vernier depth gauge, the distance from the exposed face of the casing to the central portion or hub of the rotor, as shown in Fig. 8B. It should be noted that this check will necessitate the use of a parallel strip on which the depth

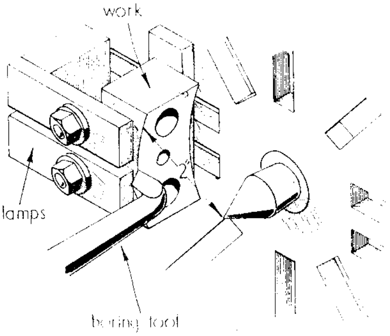


Fig. 9. The setting for machining the saddle-piece

gauge may be stood whilst making the necessary measurement. The thickness of this strip is then subtracted from the reading on the depth gauge, leaving the actual distance from the face of the casing to the rotor hub. Once this has been established, and if necessary corrected, the extra relief required by the rim may also be checked by a direct measurement from the face of the casing to the rim, as seen in Fig. 8C.

It is sufficient to make this check upon one side only, for any correction required on the other can be ascertained directly by measuring the length of the rotor with a micrometer, as shown in Fig. 8D. Before doing so, however, it will be necessary to adjust the clearance in accordance with the measurements previously made.

Cutting the slots for the vanes may present some difficulty, for this is, properly, work for a milling machine. However, after the slots have been carefully marked-out and a $\frac{3}{16}$ in. hole has been drilled axially at the bottom of each to enable the bulk of the metal to be removed with a hacksaw, the slots can quite well be formed with a hand shaping-machine. Those who are proficient in the use of a file will, no doubt, cut the slots by hand. This should present no difficulty, for once the greater part of the unwanted metal has been sawn away, there is good guidance for a file, and progress may always be checked by means of a piece of $\frac{1}{4}$-in. bright mild-steel flat stock.

As will be seen from the illustrations, the saddle is made from a rectangular piece of duralumin which has its underside machined to conform to the curvature of the blower casing. Before doing so, however, all necessary holes must be drilled and tapped while the material is still of rectangular shape. When this has been done, the piece is clamped to the lathe faceplate, and a packing piece some $\frac{1}{4}$ in. thick is interposed to allow the turning tool to pass clear of the work without damaging the faceplate. The work is then set so that, when the point of the tool is 2 in. from the centre-line of the lathe, the whole under-surface of the saddle can be machined, as shown in Fig. 9. In order to make this setting, a lathe centre is put in the headstock and the point of a stout boring tool, packed up to centre height, is aligned with the point of the centre. A reading of the cross-slide index is now taken and the tool is then moved outward by means of the feed-screw for a distance of 2 in. as shown by the index. A note of this reading is taken, for the boring tool must not be allowed to pass this point. With the tool still set at the 2 in. distance, the work is adjusted so that, when the faceplate is rotated, the point of the tool will just cut the corners of the material. When this condition has been satisfied, the tool may be backed away and machining can begin. It is advisable to use a strong magnifying glass when setting the work, as this enables the correct alignment of the tool to be seen clearly.

Mounting the Blower Unit

As it is unlikely that many users will be prepared to allot a special electric motor solely for the purpose of driving the blower, it is recommended that the wooden baseboard, seen in Fig. 4, upon which the unit is mounted, should be capable of being quickly slid into position close to some existing and conveniently placed motor. If guide strips to engage each side of the baseboard are fixed to the bench or shelf upon which the motor itself is mounted, the pulleys of the two machines will be kept in alignment ; moreover, a single holding-down bolt will suffice to set the driving belt to the correct tension.

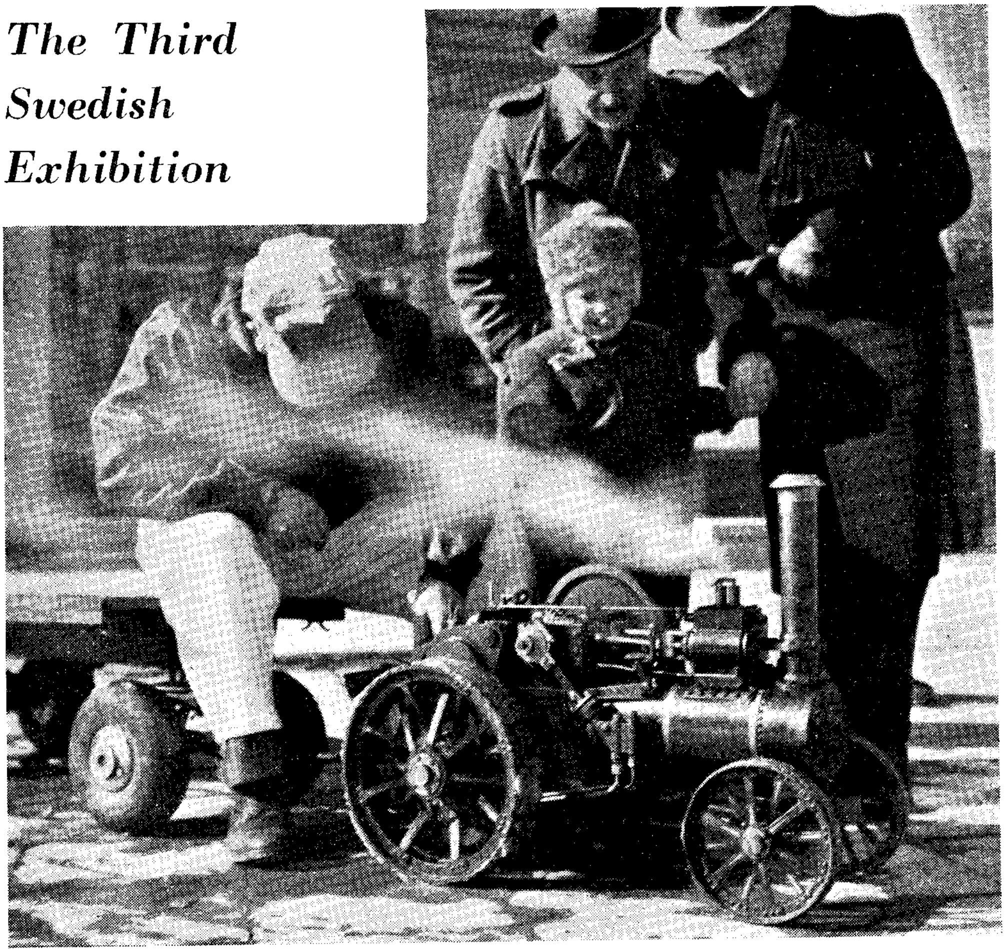
Operating the Blower

The blower may be run at 1,000-1,500 r.p.m., at which speeds it will supply all the air needed to feed an average blowpipe. If, for any reason, it is desired to run at lower speeds, the fibre vanes must be replaced by those made of bronze, as vanes of a lightweight material will not be held against the walls of the blower casing, by centrifugal force with sufficient pressure to form an adequate air seal.

Mention has already been made of the desirability of reducing the oil supply to as low a volume as is compatible with efficient running, and it will be found that a few drops per minute will be quite sufficient to maintain proper lubrication.

(To be continued)

The Third Swedish Exhibition



FEW people can visit Stockholm without being impressed by the hospitality of its citizens, the activity of its various industries and by the beauty, both natural and man-made, of its surroundings.

It came, therefore, as a very pleasant invitation when the well-known editor of *Teknik for Alla*, Mr. Olle Edner, on behalf of the publishers, asked for a selection of British models to support their Exhibition. This was held at the Technical Museum, Stockholm, under the able patronage of Intendant Althin.

Together with those of Great Britain were models from America, Canada, Denmark, France, Holland, Norway and Switzerland.

The Swedish models which numbered about 500, were of a very high standard, which showed the keen interest for the model craft in that country.

An unusual note for the Swedish countryside was provided by Mr. R. C. Hammett, who kindly took over a steam road traction engine and a 5-in. gauge steam locomotive. Thanks to the co-operation of the museum officials it was possible to run the traction engine and, as can be seen by the photograph reproduced on this page and the cover picture of this issue, it provided much interest on its trial trip in the cold, snowy weather. Other models were loaned by the following people :—

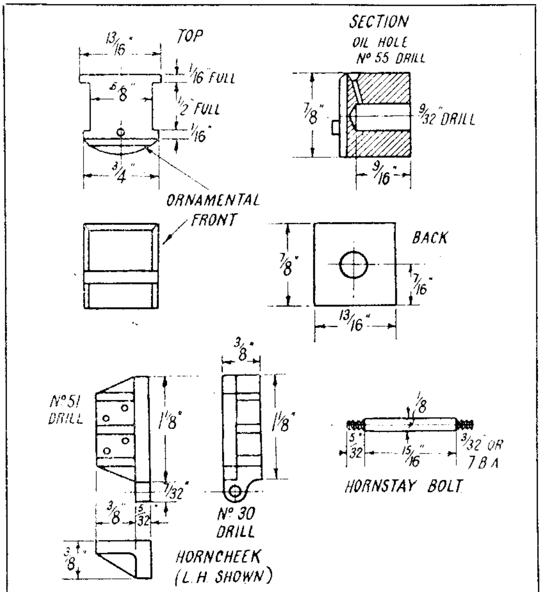
Major T. L. Wall, *Charles Galley*, 1676 ; R. G. Bosberry, M.T.B. 500 ; D. McNarry, *Cutty Sark* ; D. McNarry, *Golden Hind* ; F. W. Shipsides, Ocean Clipper *Nymph* ; W. Beaman, M.V. *Port Pirie* ; P. M. Wood, barquentine *Morning Light* ; C. T. J. Nichols, Aveling road roller ; Eng. Commander Barker, horizontal return-rod engine and model Weir pump ; A. B. Storrar, Eckert generating set ; E. P. Turpin, L.N.E.R. locomotive chassis ; I. O. Newton, Hawker Hart day bomber, 1933 ; F. J. Harvey, model E.R.A. race car ; P. Winton, Lord Mayor's coach ; F. D. Mallett, spindleback chairs and gate-legged table ; F. W. Rason, door chimes ; A. Weaver, E.R.A. race car ; T. Hammett, model violin.

Our thanks are due to Mr. Olle Edner and Intendant Althin for their kindness and enthusiasm in arranging such an excellent show, as well as to the supporters of the British team.

"PAMELA" by "L.B.S.C."

A $3\frac{1}{2}$-in. Gauge Rebuild of a Southern Pacific

THIS week it is the turn of the Southern engine again; and as probably some builders are now awaiting more details, we will get right down to brass tacks—eh, what's that? Did I hear somebody mention dummy rivets? Bless your hearts and souls, you don't find such things on a full-sized engine, so you don't find them on Curly engines. We left off with the pony frames cut out and assembled, so now we need horns, axleboxes, springs and wheels. Four horncheeks are needed, two right-hand and two left-hand. These should be castings, with strengthening ribs in the angle, and a boss cast on the bottom, to carry the bolt which forms the hornstay. Our approved advertisers should be able to do the needful; and all the "machining" needed is to smooth up the sliding face and the contact face with a file, and drill the holes for rivets and hornstay bolt. Tip for beginners; when attaching to frame, put a bit of $\frac{5}{8}$-in. square bar in in the slot, jam the horncheek against it, hold in position with a toolmaker's cramp, then drill the rivet holes in the frame, using those in the horncheek for a guide. Rivet up with a $\frac{1}{16}$-in. charcoal-iron or brass rivets. I've explained in the notes on *Tich*, how to preserve the pristine beauty of the rivet heads. When attaching the second horncheek, on the opposite side of the slot, proceed in similar fashion; but in addition, slip a piece of $\frac{1}{8}$-in. round steel rod through the holes in the bosses at the bottom. This will keep them lined up all ready for the bolt, which is just a piece of $\frac{1}{8}$ in. steel rod turned down to 3/32 in. each end, screwed either 3/32 in. or 7 B.A. and furnished with nuts. The sizes are shown in the illustration.

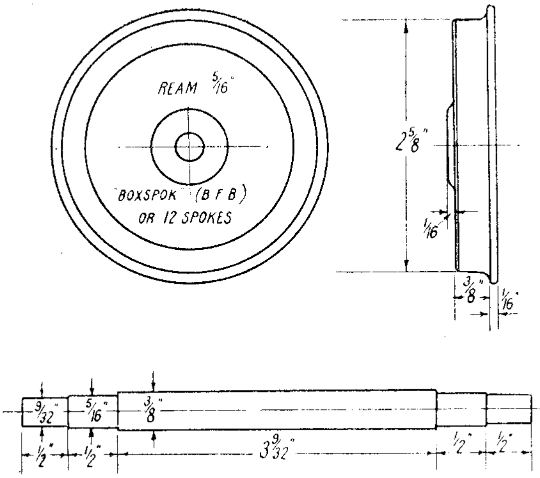


Pony axleboxes and horncheeks

If for any reason, castings should not be available, pieces of $\frac{1}{2}$-in. × $\frac{3}{8}$-in. × $\frac{1}{8}$-in. brass angle can be used, or the nearest available size larger. There isn't any particular need to bother about silver-soldering ribs into them, unless you happen to be a friend of Inspector Meticulous. Incidentally, beginners frequently complain that they have difficulty in getting short bits of unequal angle. All the time they possess a hammer and a bench vice, there isn't any need to lose sleep over a little thing like that; all their odd bits of brass sheet can be made into angles. A short while ago, one of my few personal friends came along one evening with some sheet brass oddments in a packet. In a matter of ten minutes or so, by aid of my Diacro bending brake, he had enough angles for the running-board brackets, steps, tank and bunker supports and what-have-you, for all the "angle" jobs on the $3\frac{1}{2}$-in. gauge tank engine he is building; and we drank the health of Mr. A. T. O'Neil, president of the Diacro Co., who sent me the machines, in a cup of the enginemen's best friend. The precious time they have saved for me, is beyond all calculation. "Bro. Diacro" is sending some attachments for them to make them more versatile and useful still; he is also sending a rod, tube, angle and channel bender, and a precision rod parter which shears small rod material without distortion of the ends, and to precision limits. It would knock off the whole of the firebox stays for a 5-in. boiler such as the *Maid of Kent*, in a couple of minutes or so. Our locomotive works may not be as big as Crewe, Eastleight or Ashford—but it is certainly up-to-date!

Axleboxes

Castings will be supplied for these, and as the machining and fitting is exactly the same as for those on the coupled axles, there is no need to go through the whole complete ritual again. The only variations are, that the axle holes are "blind," as the locomotive shopmen would say, they only penetrate $\frac{9}{16}$ in. instead of going right through. Don't forget the oil-holes! One box cannot be used as a jig to drill the other; so, to ensure the axle lying square across the pony frames, mark off the position of the hole very carefully in each one, plumb in the middle of the back flange. The ornamental fronts, representing the lid of a full-sized axlebox, may be any special pattern

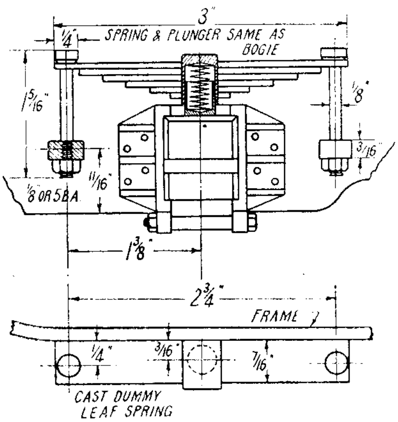


Pony wheels and axle

you fancy; the one given, is like those found on many full-sized engines. The boxes must slide freely in the horns, but should not shake, though a little side movement is advisable, to allow for tilting when the wheels follow an uneven road.

Wheels and Axles

These, again, do not call for a full description, the wheels being turned by the same method I have described "many a time and oft." The axles are turned from $\frac{3}{8}$-in. round mild-steel, held in the three-jaw. If the chuck is a weeny



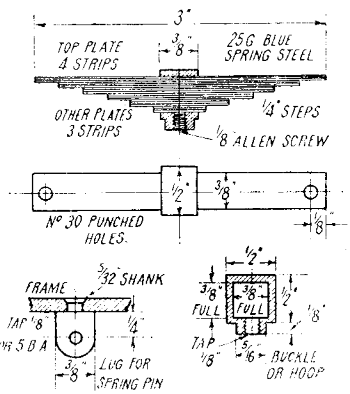
Pony spring and axlebox assembly

bit out of truth, it doesn't matter, as wheel seat and journal are turned at the same setting, and must of necessity be true to each other. If the wheel seat is slightly rough, it doesn't matter; in fact, it helps the wheel to grip without being tight enough to split the wheel boss. If, however, the journal isn't left smooth by the turning tool, touch it lightly with a fine file, and finish off with smooth emerycloth. The higher the polish, the easier the working, and the less tendency to cause undue wear in the axlebox. Tip to beginners: saw off the axle steel to full length; chuck in three-jaw, and turn one end. Remove from chuck, and very carefully mark off the distance to which you turn the second shoulder, viz. 3 9/32 in. When replacing in chuck, run up the tool and let the point of it cut a ring exactly at the marked spot. Then turn down the steel to $\frac{5}{16}$ in. diameter, press fitting, as far as the ring. Mark another ring $\frac{1}{2}$ in. from the shoulder, then turn down to 9/32 in. as far as that ring. Finally face off to length, and slightly round off the ends. Both wheels are pressed on the axle straight away.

To erect easily, remove hornstay bolts and axleboxes; put a box on each journal, drop into place, and replace bolts. The wheels should spin freely in any position of the boxes.

Springs

Two kinds of springs are shown in the drawings; the usual cast dummy variety, with a headless-buffer type spring plunger in the hoop or buckle, and the genuine working leaf spring. The latter is made on the principle suggested and used by Mr. Tom Glazebrook, in which each plate is made from three or four thin laminations, giving a flexible spring of correct appearance, often copied without even the courtesy of an acknowledgment. Both kinds will need the same type of lugs and hanger pins, as shown in the illustrations; the lugs are made from $\frac{3}{16}$-in. × $\frac{3}{8}$-in. mild-steel rod. Chuck truly in four-jaw, turn the spigot to 5/32 in. diameter and length, and part off $\frac{1}{2}$ in. from the shoulder; drill the hole No. 40, at $\frac{1}{4}$ in. from the



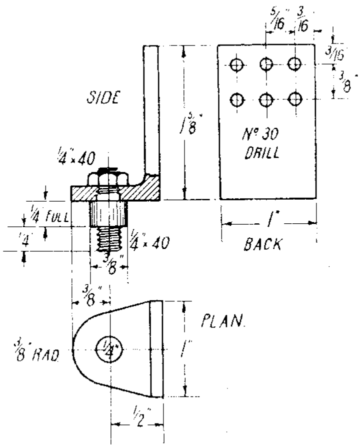
Working leaf springs (Glazebrook system)

shoulder, tap $\frac{1}{8}$ in. or 5 B.A., and round off the end. Drill a 5/32-in. or No. 22 hole at $1\frac{3}{8}$ in. each side of centre of axle, and $\frac{11}{16}$ in. from bottom of pony frame; countersink on the inside, insert the spigots of the lugs, and hammer down flush.

The spring pins are made from $1\frac{5}{16}$ in. lengths of $\frac{1}{8}$-in. round silver-steel. Put $\frac{1}{8}$ in. of thread

on one end, and $\frac{3}{8}$ in. on the other, either $\frac{1}{8}$ in. or 5 B.A. On the short threaded end, fit a circular nut made from $\frac{1}{4}$-in. round rod, screwing it on tightly, and slightly burring over the end of the thread, so that it cannot come off. Chuck the pin, and slightly bevel off the underside of the nut, as shown.

If cast dummy springs are used, and they are as clean as the samples I have received, all they will need will be drilling the spring-pin holes as shown, at $2\frac{3}{4}$ in. centres, and drilling the hoop for the $\frac{5}{16}$-in. buffer-plunger. As these are exactly the same as described for the bogie, there is no sense in wasting valuable space by needless repetition. The assembly is shown in the drawing reproduced. The bottom of the spring hoop is set level with the top of the axlebox opening, leaving $\frac{1}{8}$ in. of plunger projecting when the axlebox is in running position.



Pony king-pin and bracket

The spring-pins pass through the holes in the cast top plate, in which they should be a fairly tight fit; they are screwed through the lugs, and lock-nutted underneath with ordinary commercial nuts.

The working leaf springs are very little more trouble to make and fit, and their action is very fascinating to watch as the engine is running; they certainly get far more exercise than their full-size relations, for the great majority of small gauge railways are far from being anything like as well laid and maintained, as the 4 ft. $8\frac{1}{2}$-in. gauge variety. My own line is not too bad, taking things by-and-large, but it makes our local permanent-way gang wonder how on earth my engines manage to hold the road at an equivalent speed of between 80 and 90 miles per hour. I tell them it is only the flexible springing. Same thing applies in full size; on some American and many overseas railways, were it not for the excellent arrangements of equalised springing to be found on the bar-framed engines, there would be more locomotives off the track than on it. The way the engines roll and sway at speed, would terrify a British engine crew—but you soon get used to it!

To make up the Glazebrook springs, some blue spring steel $\frac{3}{8}$ in. wide and 0.020 in thickness (25 gauge) will be needed. It can easily be cut with tinman's snips. Four 3-in. lengths are required for each top plate; three lengths for all the others, as shown in the illustration. The hoop is made from a piece of $\frac{1}{2}$-in. × $\frac{3}{8}$-in. steel bar; good old honest mild-steel. You don't need any fancy metal for *Pamela*! Chuck truly in four-jaw, face the end, and turn a $\frac{1}{8}$-in. pip on it, $\frac{5}{16}$ in. diameter, slightly rounding off the sharp edge. Centre, and drill down about $\frac{3}{8}$ in. with No. 40 drill. Part off at $\frac{1}{2}$ in. from the shoulder. Ditto repeato, then put a $\frac{3}{8}$-in. drill through the middle of the wider side; file the hole a full $\frac{3}{8}$ in. square, to take the nest of plates. Tap the hole in the pip either $\frac{1}{8}$ in. or 5 B.A., and fit a grub-screw, preferably of the Allen type.

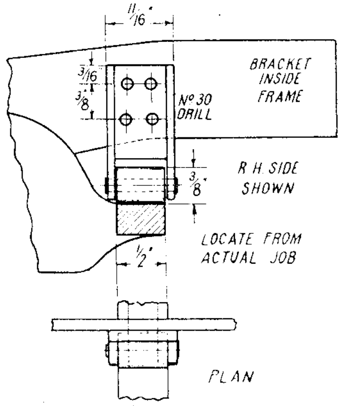
Before assembling the plates in the hoop, punch the holes for the spring pins in the laminations of the top plate. To make the punch, chuck a piece of $\frac{1}{4}$-in. round silver-steel, about 3 in. long, in the three-jaw. Face the end, and slightly bevel it off. Reverse in chuck, face the other end, and turn down $\frac{3}{8}$ in. length to $\frac{1}{8}$ in. diameter with a round-nose tool; then slightly back this off from the end, either with a file, or by setting the top slide over about 1 deg. or so. Harden and temper to dark yellow, just turning purple. Mark one of the spring plates, lay it on a flat piece of lead (I use a thin block, cast in a shallow tin lid), stand the punch on it vertically, and one good whack with the hammer will drive the business end of the punch through the steel, leaving a perfectly clean hole, and no cracks in the spring steel. Use the plate as jig to punch the others; if you put a $\frac{1}{8}$-in. bolt through the holes, after punching one end of the second plate, it won't shift whilst you punch No. 2 end, and all the holes will be in line.

I detailed this job especially for beginners' benefit, as I've seen some folk try to make holes in spring steel by drilling, centre-punching and filing off the pip, and other methods, all laborious, and liable to split the steel. It's so easy *when you know how*! In the days gone by, when I had time to repair gramophones and similar things for a couple of friends in the trade (both, alas! now long since passed to the land beyond the Jordan), I punched many hundreds of holes thus, as I made all my own governor springs; it was not only far cheaper than buying them ready punched, but the size and thickness could be suited to the particular spring motor being repaired. Incidentally, these repairs gained my friends quite a reputation, in a small way, and I could easily have earned a living by doing them for the wholesale firms who contracted for the retailers' repair work; but I just wasn't interested. What I did, was merely for friendship's sake; and my last job in that line was done in July, 1929, which seems a long time ago!

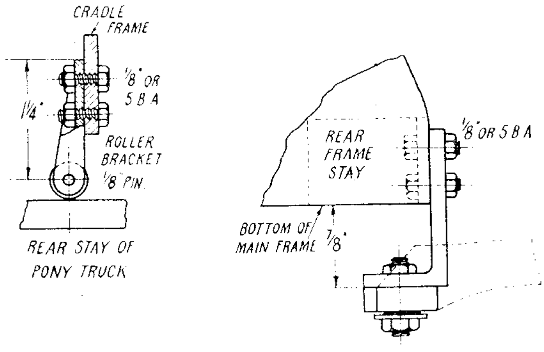
It may try your patience, assembling the spring plates in the hoop, but with a little judicious wangling, the job can be done fairly quickly; then tighten up the Allen screw as much as possible without stripping the thread, and erect

the spring exactly as given for the cast dummy spring. When the axlebox is in running position, the working leaf spring should just be "taking the strain"; final adjustment cannot be made until the engine is finished and in running order, but this is merely a question of screwing the spring hanger pins in or out of the lugs, as required, and tightening the locknuts.

the same arrangement of roller bearings for transferring the weight of the trailing end, to the pony truck, as on my *Tugboat Annie*; but as the brackets carrying the rollers wouldn't have cleared the alternative closed-in cradle, on a sharp curve, I just turned the whole issue upside down, and substituted brackets which can be attached to the sides of the cradle, as you can



Roller brackets for trailing end



How to erect pony truck

see. These are suitable either for the original wide cradle, or the alternative narrow one. Our approved advertisers may supply cast brackets for carrying the rollers; but failing that, the brackets may easily be bent up from sheet metal, or cut from the solid, just whichever you may prefer. A piece of ½-in. × ⅜ in. × 3/32-in. channel steel would also make a couple of nobby brackets, merely requiring to be filed up to the outline shown, and drilled for the bolts and the roller pin.

If bent up, use a piece of 3/32-in. or 13-gauge soft sheet steel approximately 1½ in. wide, and bend it over a piece of ½-in. steel bar to a channel shape, with 5/16-in. sides. Drill a No. 32 hole each side, at the bottom, for the roller pin, then round off as shown, sloping the sides away "to zero" at the top. Drill four No. 30 holes for the bolts, as indicated, and file away sufficient of the back part, at the bottom to allow the roller to clear. To make the rollers, simply chuck a bit of ⅜-in. round silver-steel in the three-jaw; face the end, centre, and drill No. 30 for a full ½ in. depth. Part off at a full ½ in. from the end; repeat operation, then rechuck with the parted side out, and take off a cleaning-up skim, bringing the length to ½ in. bare. Put the roller between the flanges at the bottom of the bracket, and drive a ⅛-in. silver-steel pin through the lot, slightly burring the ends of the pin outside the bracket, if there is any suspicion of slackness. The roller must be perfectly free on the pin.

If gunmetal castings are used, they should have ⅛-in. flanges. They should only need cleaning up with a file, and drilling for bolts and pins. As it would need a hefty milling machine to mill the brackets from ⅝-in. × ⅜-in. bar, and the results wouldn't be in any way superior to cast or bent brackets (though they would certainly look very swell!) I fancy all

King-pin and Bracket

Another simple job! The bracket holding the king-pin is merely a 1-in. length of steel angle, of 1⅝ in. × ⅞ in. × ⅛ in. section. Smooth off both ends; then, in the middle of the shorter side, which forms the foot, drill a ¼-in. clearing hole, and round off the piece to the shape shown. In the upper part of the longer side, drill six No. 30 holes for the bolts securing the bracket to the rear frame member, as shown in the drawing.

The king-pin is a piece of ⅜-in. round steel, same stuff as used for the pony axle will do fine, squared off at each end to an overall length of ⅞ in. full. One end is turned down to ¼ in. diameter for ¼ in. length, and the other to ¼ in. diameter and ⅜ in. length; both are screwed ¼ in. by 40. The nuts are made from ⅜-in. hexagon steel, a kiddy's practice job needing no description. Poke the longer end through the hole in the foot of the bracket, and secure with a nut.

The bracket is erected behind the cross stay connecting the rear ends of the main frame, and the trailing cradle. Set it exactly in the middle, with the bottom of the foot ⅞ in. below the bottom edge of the main frames, as shown in the detail illustration; hold in position with a toolmakers' cramp, drill through the cross-stay, using the holes in bracket as guide, file off any burrs, and secure with ⅛-in. or 5-B.A. bolts and nuts. The hole in the front stay of the pony truck goes over the plain part of the king-pin, and is secured by a nut and washer as shown. You don't need yards and yards of instructions for erecting a Curly engine!

Roller Bearings

They say second thoughts are best; they were in this case. I originally intended to specify

builders will give that method a miss!

The position of the brackets can best be located from the actual job. Jam the axleboxes of the pony truck in running position, with the centre of the axle at $\frac{9}{16}$ in. above the bottom edge of the pony frame. This is easily done by putting a wedge between the bottom of the axlebox, and the hornstay bolt. Then put the pony truck in place, on the king-pin, and stand the chassis on a level surface, or a piece of rail, if any is available. Put the brackets inside the cradle frames, with the rollers resting on the rear stay of the pony truck, and exactly in line with it, as shown in the illustration of the assembly. Hold in position with a toolmakers' cramp, drill holes through the cradle frames corresponding to those in the brackets, file off any burrs, and use $\frac{1}{8}$-in. or 5-B.A. bolts to secure the brackets to the frames, as shown in the part cross section. That practically completes the chassis work as far as running gear is concerned, the next jobs being cylinders and motion; and here, I am curious to see if, and how far, your humble servant will anticipate full-size practice. I've done it before, as followers of these notes know full well.

An Inadvertent Test

Everybody being entitled to their own opinion, it only amuses your humble servant when all sorts of prejudiced arguments are put forward to decry my pet frame construction, with buffer beams made from steel angle; but facts are facts, and the other afternoon, one of my frames inadvertently got a test which proved that my construction can take a knock which would just about cattle up other kinds. It so happened that I needed a small engine on which to carry out some boiler experiments, so I started in to build a *Tich* "on the quick." The frames and angle buffer beams were duly cut out, assembled, and the joints Sifbronzed up with my oxy-acetylene blowpipe. Just outside the glass lean-to ("Crystal Palace") where my blowpipe work is done, are four steps leading up to the garden, and by the side of them, a brick wall about four feet high. When the doodlebugs were flying around, back in 1944, I used to put my drawing-board, or writing-pad, on top of this wall, and sit on the top step to write or draw. The steps leading to our shelter under the garden, are at the end of the wall; and as soon as I heard a whine, I would call to my fair lady, and we would both go down in the shelter, not knowing whether we would ever come up again, but hoping for the best. Incidentally I made the drawings, and wrote most of the instructions for "Petrolea" under those circumstances, and made far less mistakes than many folk do in the normal way. Whilst I was drawing out the valve gear one afternoon, seven doodlebugs came over in five minutes, all of them exploding within a radius of half a mile or so; yet that valve gear does the job!

Well, after Sifbronzing the frame assembly, I put it on top of the wall to cool down, whilst I disconnected my blowpipe and put it away; I never leave it connected up to the gas cylinders. Just as I had finished, it started to rain. I didn't want the frame to stay out in the rain, so went out to get it; but it had already got wet, and when I picked it up, it slipped through my fingers, and fell cornerwise on to the concrete surface four feet below. Judging from the crack it made when it crashed, I thought I was in for a nobby job of straightening out. Anyway, I picked it up, and found it apparently undamaged, so took it into my workshop, wiped all the wet off it, and laid it upside down on my surface-plate. You can judge of my relief when I found that *there was not the slightest sign of a rock*; the frame had remained true. It must have gone down a tidy whack, as the corner of the beam was burred, where it hit the concrete; but a file soon settled that. Any other construction would have either been twisted, or knocked into a rhomboid form. "Nuff sed!"

Incidentally, I don't known whether my time on this job is a record, but I cut the frames out in forty minutes; fitted hornblocks, machined the slots, cut and drilled the buffer beams, and Sifbronzed the assembly, in three hours; made and fitted the pump complete in three hours, and took the same time turning the wheels, axles, and crankpins, and erecting the lot. I have the tools and machines for the job, and don't have to stop and think what to do, but it may give the good folk who follow these notes, some idea of the way I have to "go for it," if I want to do any locomotive work. I only wish to goodness my poor worn-out noddle would let me do my writing, drawing and correspondence, at the same speed!

For the Bookshelf

The British Journal Photographic Almanac, 1950. (London: Henry Greenwood & Co. Ltd.). Price 5s. net.

This very comprehensive reference book needs no introduction to professional and amateur exponents of photography, for it has been published in its present format since 1866. The leading articles in the latest edition cover such subjects as: The importance of colour photography in daily life and education; Medical photography; Getting ready for colour; Remote control devices for cameras; A photographic dealer "takes stock"; Miniature transparencies by the reversal process, and Advice to amateurs.

In addition, there is the usual photographic supplement comprising thirty-two gravure reproductions of first-class examples of modern photography; a review of new goods; a glossary of photographic terms; lists of chemicals and processes for photographic work; exposure tables and a wealth of other useful information relevant to the subject. By no means the least interesting pages are those devoted to the very large number of advertisements, and the production is of excellent quality throughout. A cloth-bound edition is available at 7s. 6d. net.

*The "B.R.M."

Its Construction to 1/10th Scale

by Rex Hays

WHEREAS I found the rear suspension of the "B.R.M." typical Grand Prix de Dion, as used on the 1938 Grand Prix Mercedes Benz, the front suspension follows the Porsche layout as used on the Auto Union and "E" type E.R.A.'s. It is composed of trailing links and ball pivots—the oleo strut which is connected to the top trailing link beyond its inboard pivot on each side of the radiator cowling, is hidden within this cowling.

Now, to arrive at the length of the trailing links, several factors had to be taken into consideration; these factors were the wheel base of the car related to the location of the front wheels relative to the body of the car seen in side elevation, plus the track of the car, not forgetting that the track is taken from the tyre centres to which must be added the amount the brake drums stand out beyond the tyre walls. If these aspects were borne in mind and accurately estimated, helped as I indicated in my first article, by certain body features, both the length and the trailing angle of the trailing links could be, and were, in fact, established. They were fashioned in the manner illustrated and as follows :—

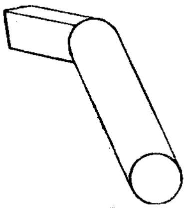


Fig. 1

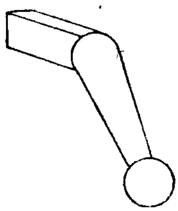


Fig. 2

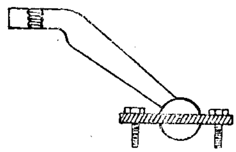
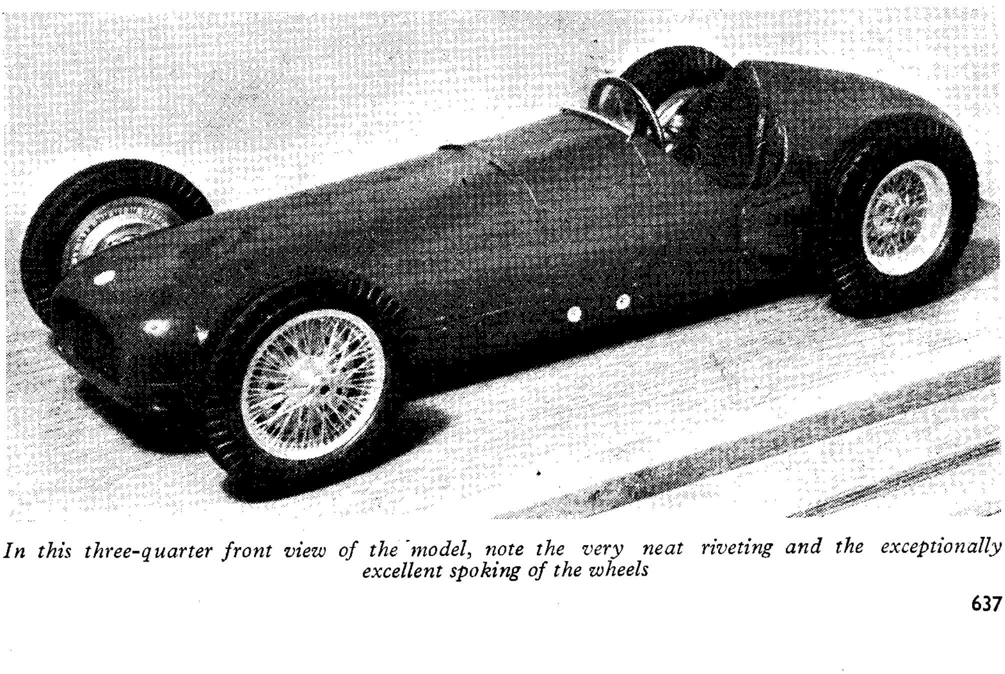


Fig. 3

Four short lengths of brass rod were bent, and at the bend were filed flat on both sides (Fig. 1). Each being at this stage, over-size in length, was then put in the lathe and a ball and a taper turned (Fig. 2). These trailing links are fixed to the brake drum by a flange through which the ball pivots operate, so a flange was made and an over-

*Continued from page 607, "M.E.," April 27, 1950.



In this three-quarter front view of the model, note the very neat riveting and the exceptionally excellent spoking of the wheels

size hole drilled in its centre, and the ball, protruding through the back of the flange, was soldered into position (Fig. 3).

The front brake drums were designed in the same manner as the rear drums referred to in my last article, and the flanges containing the

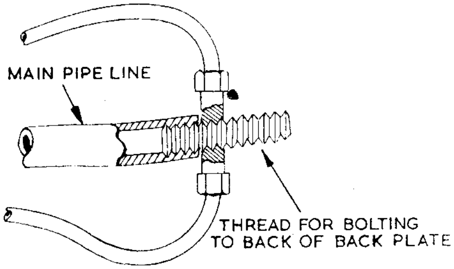


Fig. 4

ball pivots were located correctly, the location, it may be recalled, having been arrived at during the earlier calculations on the body work, and bolted into position on the detachable back plate of the drums, a hole having been drilled in this back plate to accommodate the ball protruding through the flange.

The hydraulic brakes on this car are Girling and have three leading shoes and two independent pipe lines. This detail I showed in the following manner :—

The main pipe-line emerges from the body work and is located on the front end of the back-plate, where it joins the centre of a junction of the two independent pipes, one of which leaves the top of the junction and travels just under the top trailing link to the rear, and the other leaves the bottom of the junction and travels just under the lower trailing link to the rear. The illustration, Fig. 4, shows the construction of this. For the assembly of the front suspension, the trailing links were bolted by their flanges to the backplate, the rear bolt incorporating a vertical greaser ; the hydraulic brake gear was also bolted into position, and the whole assembly in turn attached to the brake drum, and

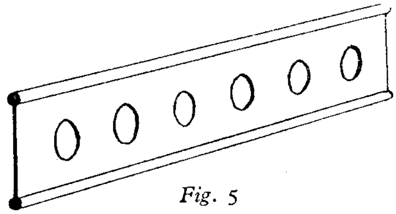
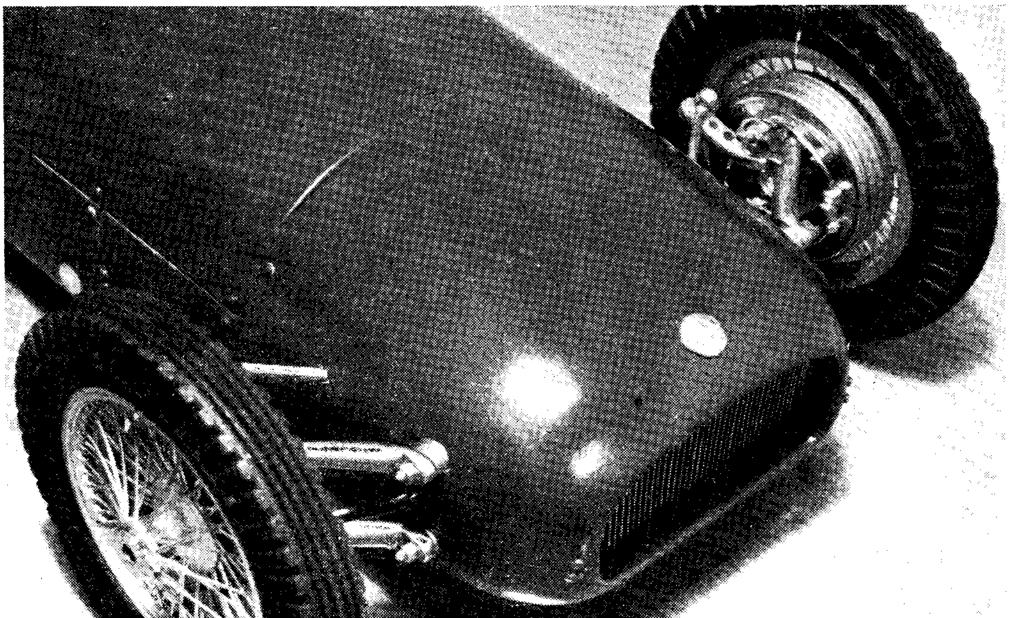


Fig. 5

fixed into position by the steering arm which acted as the " nut " for the fixing, in the same manner as the universals had done for the rear.

The whole front suspension can be clearly seen in the close-up photograph of the front of the car.



A close-up of the front end of the " B.R.M." model, showing the business side of the anchoring mechanism !

Cockpit Details

I have noticed many times that people examining models of racing cars, nearly always start by peering critically into the cockpit, and I have always endeavoured to give these characters

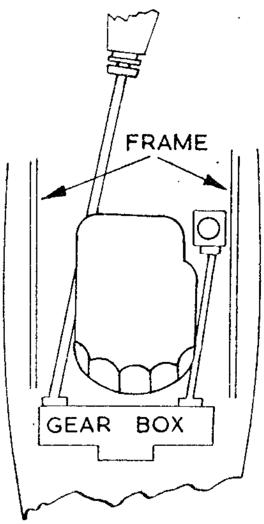


Fig. 6

something accurate to study, and, in the case of the "B.R.M." I found it possible to furnish this department quite adequately.

In the first place, we have the chassis frame which is visible from the bonnet bulkhead back to the first tail bulkhead behind the seat.

The frame on the "B.R.M." consists of two small diameter steel tubes, one above the other and joined by a drilled steel sheet (Fig. 5), the depth of this frame being about 6 in. Two of these members were made up in brass and fitted to each side of the inside of the cockpit—they are parallel with each other.

Next, it was necessary to estimate—first—the angle at which the propeller shaft cut across the cockpit floor caused by the engine being mounted at an angle across the chassis, and—second—the fore and aft inclination of the propeller shaft, caused by the fact that the engine is mounted at an angle of approximately 5 deg. from the horizontal. For this it was necessary to add to my plan and side elevation drawings, the two angles at which the engine is mounted relative to the location of the gear box, which is placed immediately adjacent to and in front of the differential casing.

The propeller shaft enters the near-side of the gear-box in close proximity to the frame. By experiment on the drawing-board, I found that it was possible to arrive at these angles and inclinations with a very fair degree of accuracy—this accuracy confirmed to a great extent by the fact that both the seat and gear-change gate fitted very snugly into the assembly.

I then turned up the clutch-housing out of brass and to it fitted the propeller shaft, mounting these parts to give the correct angle and inclination. The seat was upholstered in leather paper and padded with cotton wool, and the gear-change gate (5 speeds and reverse) was filed out of sheet brass; the gear lever also turned from brass, disappearing into the "gate," and bolting to the change speed shaft which emerges from the back of the "gate," and enters the gear-box on the off-side (Fig. 6). The clutch pedal emerges from the clutch housing with the brake and accelerator pedal on the right.

The instrument panel was filed out of aluminium and polished. All the experimental instruments were shown; they are from left to right, temperature gauges for oil and water, etc., electric rev. counter, further temperature gauges and oil pressures.

The steering wheel (the same type, incidentally, which is used on the Ferrari Grand Prix cars) was also filed out of aluminium (spokes and rim) and polished, the rim being sandwiched between the wooden grips riveted to it, with finger grips filed on the leading edge, the wooden grips being well finished, shellaced and left unpainted. The two large diameter petrol pipes which are located on either side of the seat, and which connect the tank in the tail to the saddle tank under the scuttle, were fixed into position. It may be remembered that this arrangement of tail tank and saddle tanks connected by large diameter

(*Continued on page* 642)

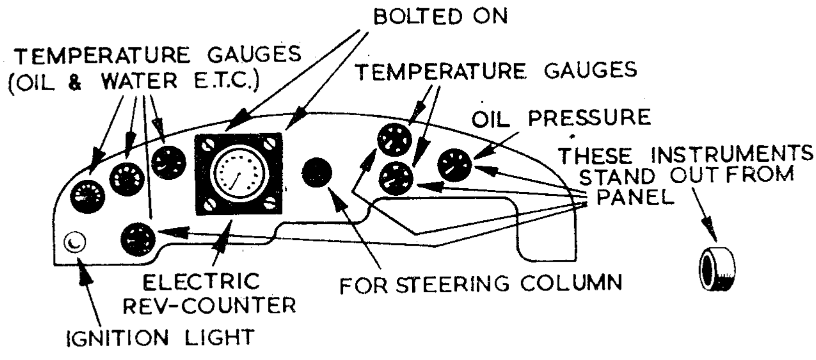


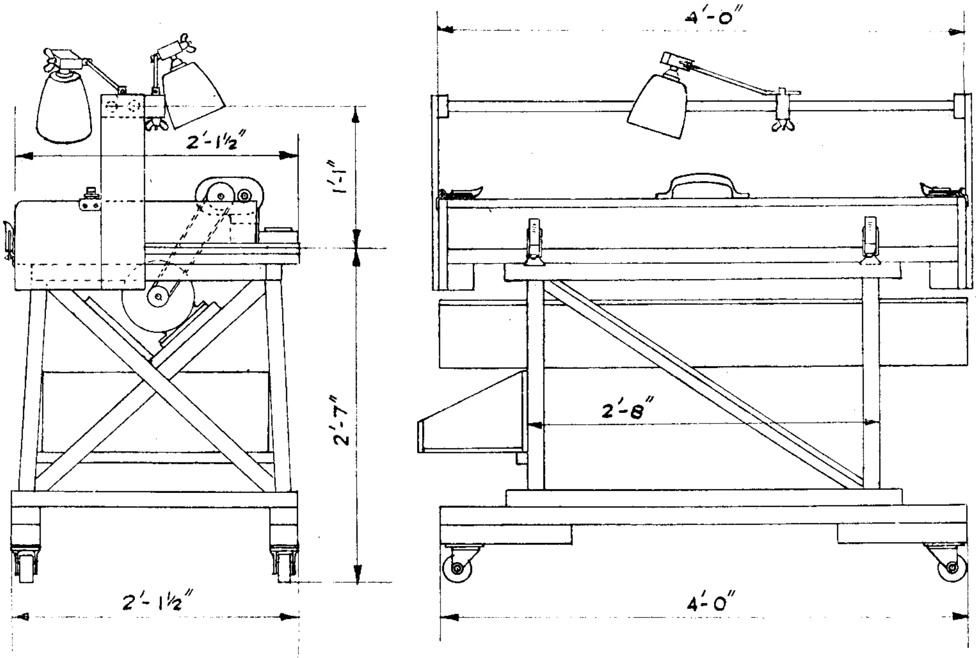
Fig. 7. *Instrument panel*

Operation "Transition"

A further stage in the life of a Portable Work-Bench

by D. S. Clibborn

IN THE MODEL ENGINEER for July 9th, 1942, there was published an article concerning a light portable-type of work-bench resembling an elongated tool-box, which enabled me to carry on with the construction of some gauge



Side and front elevations of the mobile work-bench

"O" rolling stock, in spite of several changes of address brought about by the war. This bench proved to be a boon, in that it provided a means of recreation and diversion, as time permitted, in a period of considerable stress.

With the return to a more settled life, it has been found rather difficult to create a workshop, as such, in the home premises, where light and warmth would be available without jeopardising the family fuel budget, or without encroaching on valuable space required for family needs of higher priority. Hence the decision was reached to incorporate the original portable work-bench in a new mobile bench of larger size, on swivel castors, to enable it to be moved from one location to another, and to be parked conveniently covered with a suitably shaped brown dust sheet to maintain an appearance of tidiness. This cover would also keep the kiddies from poking their noses and fingers into Daddy's "toys" at inconvenient times when he was not on the premises to maintain law and order.

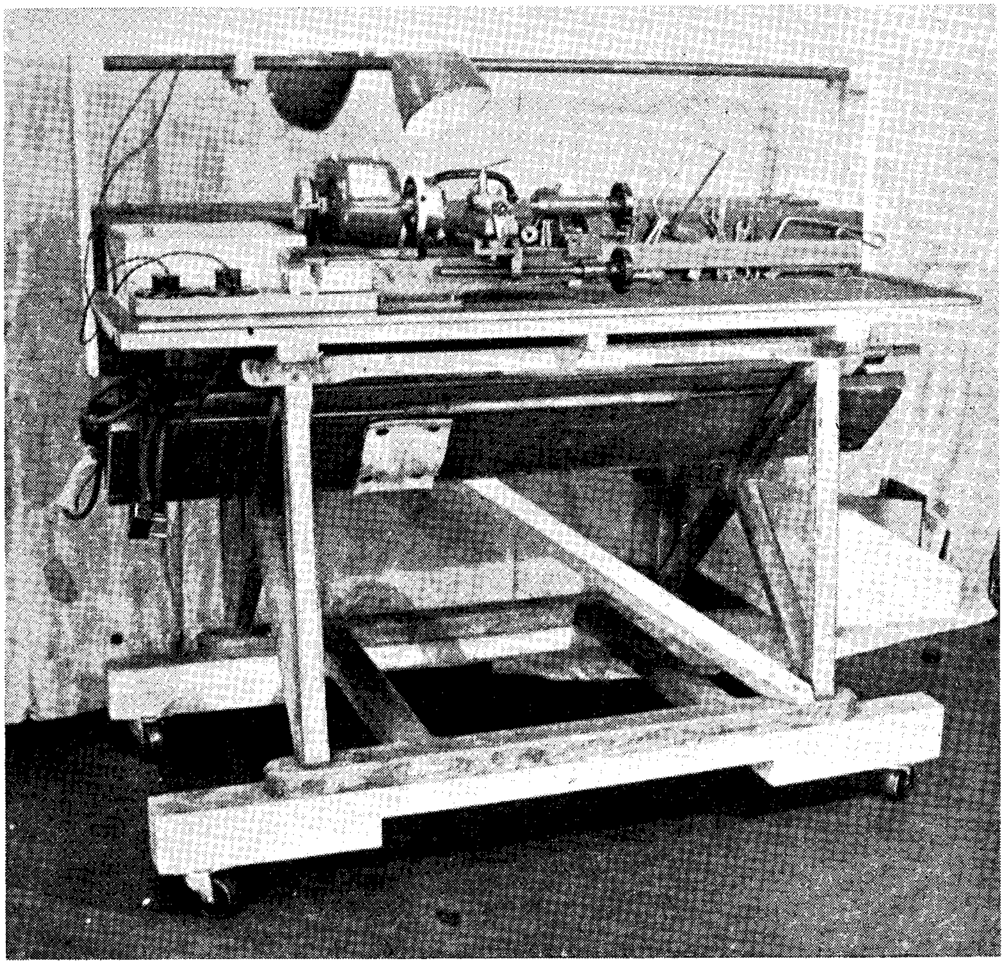
The sketch and photographs will indicate the general scheme, from which it will be seen that the original bench has been set on top of a rather nondescript frame with an additional light bench behind to take the Rollo ELF lathe, and with space for the mounting of a light drilling machine at a later date. A wooden trough below is used for "stock racks," and also for mounting the ¼-h.p. motor, and for parking the electric soldering-iron and electric hand-drill, when not in use. There is also, mounted on one end of the under frame, a wooden box suitably cut and partitioned to accommodate odd scraps of wood used in railway modelling, and for sundry jobs that one finds require assorted pieces of wood.

Some details of construction may be of interest. The main oak underframe was acquired as obsolete from a joinery establishment, for a

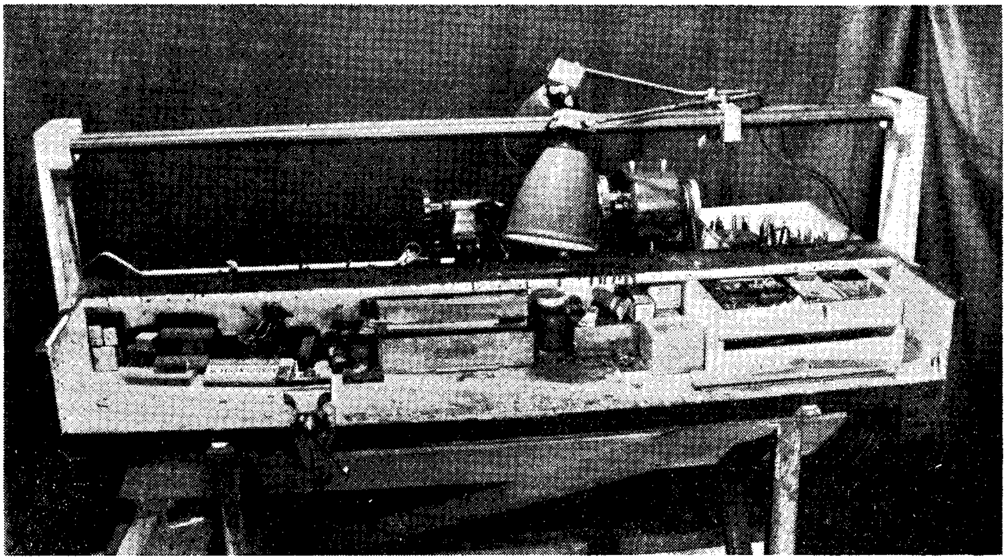
reasonable sum, the side diagonal bracings were cut out to make leg room on each side, and a single bracing added across the inside corners to which the trough boards are screwed, thus stiffening the whole assembly. The longitudinals below the frame give a good wide mounting for steadiness, and these, along with the packing-pieces immediately over the castors, bring the bench surface to a suitable height.

The original portable bench has had the end handles removed and the cover handle transferred from the side to the top. The cover hinges have been removed and four toggle catches from ex-W.D. ammo. cases have been added to hold the cover in the closed position. When the bench is in use, this wooden cover is laid on one side. No alteration has been made otherwise to this original bench, but two trays have been inserted to hold loose detonator tins, which act admirably as " store " receptacles for nuts, bolts, screws, washers, gears, buffers, couplings, etc., etc. The Junior Imp vice, which has given excellent service to date, is fixed to the bench as required by its turnbuckle screw.

To the rest of the frame has been added the light wooden top mentioned previously with a covering of brown ship's linoleum, and a half-round bead of aluminium on the edge to secure and protect it at one and the same time. The leather belt drive for the " ELF " lathe comes through two holes in the bench top from the motor which is mounted on a rubber pad on one side of the V-shaped trough. This helps to reduce motor hum. At the extreme end, beside the lathe, there is a wooden block with two 5-A shutter-type sockets, and a fused switch for the motor. A flex with 15-A plug, leads the power to this block from any domestic power socket. Between the block and the back of the original bench, a box has been constructed



The complete assembly of bench from back (note space on right hand side to accomodate drilling machine.



The original bench on new frame, showing "stores" boxes

to take all the accessories for the lathe: tools, catch plates, chucks, etc., while along the back a wooden rack accommodates all manner of tools like screwdrivers, spanners, scribes, centre-punch, try-square, etc.

The V-shaped trough has had a few spars of wood and metal brackets added on both the inside slopes to take light bars, angles, stripwood, etc., etc. Two travelling specific lights are attached to two tubes carried on wooden end frames, and are plugged as required into the 5-A sockets. It is intended ultimately to operate them from a transformer at 25 V for safety. (This top arrangement also acts as a support for the dust cover mentioned previously.) Two people can work at the bench simultaneously, one on either side, if desired.

Many more tools are necessary than those seen in the photographs, but these are accommodated in a tool-box elsewhere, the tray of which, containing hammers, chisels, larger screw drivers, saws, pliers, etc., etc., can be placed on the light part of the bench till such time as the bench drill is acquired. Thereafter two folding brackets may be added to the end farthest from the lathe to hold this tray of tools.

It will be appreciated that some painting has yet to be done to bring the whole arrangement to a uniform appearance. Meantime, about two years' use has been enjoyed of the affair, as it stands, and I can confirm that it has been a great asset. It is possible to leave "work in progress" out of sight and harm inside the original bench or under the dust sheet cover. Operations can be carried out in one of two rooms on the ground floor (dining-room is excepted), where the family is gathered on a winter's evening, and everybody is happy—which is just as it should be.

No radio receiver or radiogram has yet been mounted on it, but it is a possibility!

The "B.R.M."

(*Continued from page* 639)

pipes, was a cockpit feature of the 1938 Grand Prix Mercedes Benz.

Lastly, the exhaust pipes were fitted to the underside of the car. The "B.R.M." has four small diameter pipes, one for each bank of four cylinders.

The model is finished in British racing green with silver wheels and polished hub-nuts. The brake drums, trailing links, steering arms, de Dion tubes, half shafts, radius arms, frame, clutch housing, gear lever and change-speed gate and shaft, steering column, exhaust pipes and radiator grille, were all dull chrome and semi-polished, as were all the nuts and bolts used in the assembly.

In conclusion, I think that, perhaps, it is only right to remind readers that this model is a replica of the "B.R.M." in its present form. We shall, no doubt, see it come to the line with a large number of modifications, especially, in all probability, to the radiator cowling, and, most certainly to the instrument-panel, and when it does eventually appear on the "grid" with the pick of the continent's Grand Prix Formula 1 Racing Cars, I am sure you will all join me in wishing it very great success.

Novices' Corner

Making a Pair of Packing Blocks

PACKING blocks have many uses in the workshop, and when accurately machined they provide a ready means of setting work parallel with the surface of either the surface-plate or the lathe faceplate. Moreover, the machining operations involved in making the blocks are a little out of the ordinary and will form a useful exercise in turning.

The pair of blocks illustrated in Fig. 1 were machined from iron castings supplied by Mr. W. H. Haselgrove, of Petts Wood, and it will be seen that each is provided with two bolt-holes which can be used to secure the blocks in position.

The size of the block: $3\frac{1}{2}$ in. long, $1\frac{5}{8}$ in. wide and 1 in. deep, also renders it suitable to serve as a base for mounting the test indicator, especially when this instrument has to be used in a confined space; in addition, the block may be employed to form the base portion of a gauge for setting the lathe tools to exact centre height. A further application is to use the block as the base of a dwarf surface-gauge for marking-out small work on the surface-plate. When used on the table of the drilling machine or on the lathe faceplate, the blocks can either be bolted in place, or the parts being machined can be secured by bolts passing through both the work and the block.

On the surface-plate, the blocks will be found useful for setting work parallel when marking-out, for, by turning the block over, three different height dimensions are immediately available.

Machining the Packing Blocks

If the following machining methods are adopted, the two blocks will be made similar in length, breadth and depth; that is to say, the accuracy of these dimensions will correspond with the accuracy of the lathe itself. As in all work of this kind, the first requirement is to form a datum surface to serve as a basis for the subsequent machining operations. The castings are, therefore, gripped one at a time in the four-jaw chuck and the base is machined flat. As previously mentioned, it is advisable to remove the surface scale and sand from the iron castings, by a pickling process, before the machining is undertaken; this will help to preserve the cutting edge of an ordinary high-speed steel tool and, at the same time, will ensure that these abrasive substances do not come into contact with the working parts of the lathe. The machining of iron castings will be greatly facilitated if a tungsten carbide tipped-tool is used instead of the ordinary type of lathe tool, for the cutting edge of the former will not be blunted by any hard particles in the casting and, moreover, there will be no need to employ the back gear even when turning parts of large diameter. A further advantage is that a better finish is given to the work, owing to the relatively high turning speed and the ability of the tool to remain really sharp throughout the machining operations.

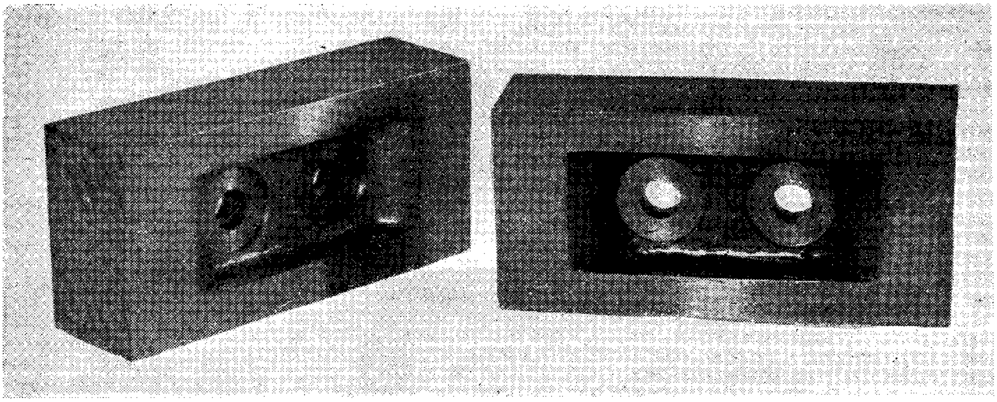


Fig. 1. The finished packing blocks.

The next operation is to machine the opposite faces of the castings, and, to ensure that the blocks are made of equal width, they are mounted together on the lathe faceplate, in the manner illustrated in Fig. 2.

Easier Clamping

The work of clamping the castings in position will be rendered easier if the faceplate is removed from the lathe and rested horizontally on the bench. The guide circles turned on the surface of the plate can then be used to set the work as nearly centrally as possible, so that the parts will be in balance during the turning operation.

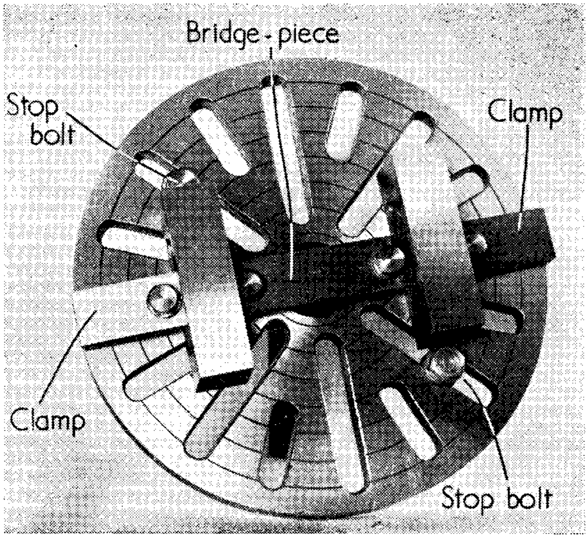


Fig. 2. Method of mounting the castings on the lathe faceplate.

As will be seen in the photograph, the cast-in recesses are utilised as abutments for both the central bridge-piece, or strap, and for the outer clamping plates. All these clamping devices are secured by means of bolts passing through the slots formed in the faceplate. It should be noted that the bolts are positioned close to the casting itself, in order to afford nearly direct clamping pressure without risk of bending the clamps. The outer clamp plates have their free ends supported on packing-pieces equal in thickness to the step in the casting. Although it is quite possible that the castings may be firmly gripped in this way and able to withstand the cutting pressure without moving, any tendency for the blocks to slide on the faceplate will be checked if stop-bolts are fitted as represented in the illustration.

The frictional contact will also be increased if a sheet of paper is placed between the work and the faceplate.

Facing

Now that two parallel, flat surfaces have been machined on the castings, they can be mounted, one at a time, in the four-jaw chuck for facing the upper surfaces and forming the bolt holes. Before doing this, however, the centres of the bolt holes should be marked-out and then centre-drilled in the drilling machine.

Next, grip the casting in the four-jaw chuck and face the surface ; then set the work with the aid of the centre-finder so that one bolt centre runs truly ; drill the bolt hole to the clearing size, and form the flat bolting-face for the washer with a small boring-tool. This bolting-face must be machined sufficiently deep to allow the nut, when in place, to lie below the surface of the casting. These operations are repeated to form the second bolt hole and bolting-face.

It should be pointed out that a nut with its washer, or a bolt-head, should never be pulled down against an irregular or unmachined surface, for this may result in bending the bolt and providing an insecure hold.

To ensure that both blocks are machined to an equal thickness, the bolt holes are utilised to bolt the two castings to the faceplate so that they lie in diametrically opposite positions and approximately equidistant from the centre. The two blocks are then either merely faced flat and to an equal thickness or, if preferred, they can be machined to an exact thickness with the aid of the leadscrew index. For this purpose, the index is turned to the zero position, and the tool is brought into contact with the stationary faceplate by feeding the top slide forward. Where the leadscrew is of $\frac{1}{8}$ in. pitch, it can then be used to measure exact eighths of an inch by reference to the leadscrew index. This method of accurately sizing the blocks can, of course, also be applied at the turning operation for machining the castings to breadth.

It now remains to face the ends of the castings and, if desired, to machine them to an exact length. This may be done, as illustrated in Fig. 3, by gripping the two blocks together, between supporting packing strips in the four-jaw chuck. When their ends have been faced, the castings are reversed in the chuck to enable them to be machined to the same length. This completes the machining work, and, if greater accuracy is required, the blocks should be scraped flat with reference to a surface plate.

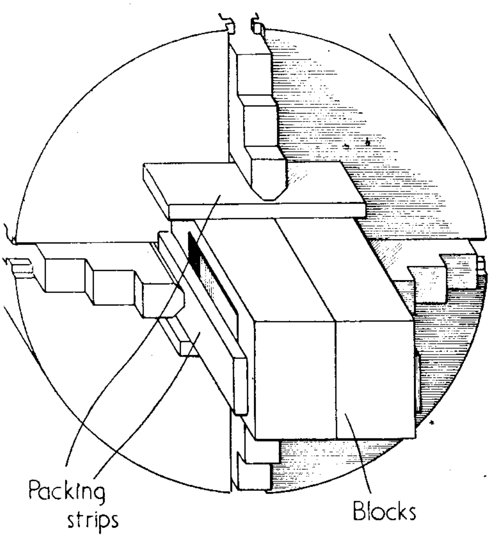


Fig. 3. The blocks mounted in the four-jaw chuck for machining the end faces.

CAST TRESTLES FOR TRACKS

WE have lately been able to examine some samples of a cast trestle specially designed and produced by Lamedos Industries Ltd., of Eton, Bucks., for use as the foundation of an outdoor passenger-carrying track. The trestle is a duralumin casting, and is the result of considerable experimenting on the part of Mr. Charles R. Bielby, Managing Director of Lamedos Industries, who possesses a 5-in. gauge portable track and has had plenty of experience of the problems of erecting and operating of such a track. The original timber supports, as usual, gave a great deal of trouble ; so, with a view to avoiding further difficulties, some thought was given to the possibility of substituting metal for timber as a more suitable material for the supports. In due course, a cast duralumin trestle was produced, and we had an opportunity to inspect it. It seemed to be just what was wanted but appeared to be somewhat unnecessarily massive ; so the section of metal was reduced and the trestle seen in one of the reproduced photographs is the result. The present section is strong enough to carry the proverbial house ; yet it is extremely light, which is a great advantage when the track has to be transported to garden fetes and similar functions.

Timber trestles exhibiting their particular brand of trouble !

Contrasts

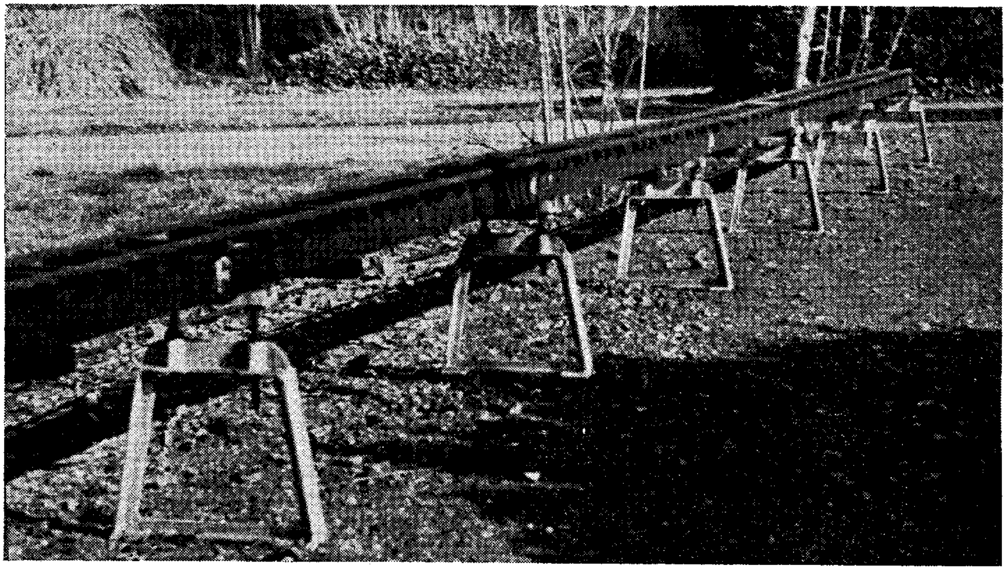
Of the two other photographs, one illustrates the condition of the timber-supported track when the idea of metal trestles first presented itself ; the other photograph shows some of the new cast trestles after being in use for twenty months, and the contrast is plain to see.

The design of these trestles is simple and straightforward. The trestle itself is cast with cored holes to receive the ½-in. diameter adjusting-bolts, and no machining of any kind is necessary The adjustable bracket has elongated slots in the feet, to allow for side adjustment.

The dimensions of the bracket are based upon the assumption that side rails for the track sleepers are made from 3 in. × 1 in. timber, which permits of the use of all gauges up to 5 in. In Mr. Bielby's track, the sections are each 6 ft. long and the spacers between the side rails are 4-in. lengths of 4 in. × 2 in. timber. In each end spacer, a ⅝-in. hole is bored and a long bolt passed through, first, one spacer, then the adjusting bracket, then through the spacer of the next section, and the lot nutted up—a matter of, perhaps, two minutes.

Easily Erected

Provided that the sections are well made, a track of 150 ft. length can be erected, or dismantled, in about twenty minutes by one person. As the sections, or units, are only 6 ft. long, they are easily transportable. Extensions can

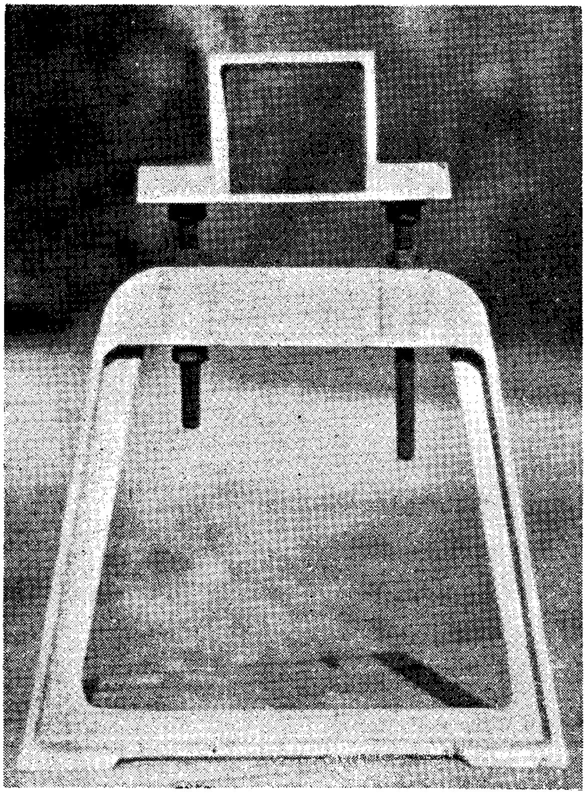


Cast aluminium trestles after twenty months' use.

be made without any regard to long-term surveying, digging or concrete-mixing for posts.

So far as the cost is concerned, the trestle and bracket castings work out much cheaper than timber, even if *seasoned* timber is available, and if the labour and time of construction are included. Taken over a period of time, the costs disappear, because there is no necessity for replacements, repairs, maintenance and painting.

We think that readers will agree that the appearance of the cast trestles is much neater than that of timber ones; but there is one other important point worth mention, which is that the track, once erected, is always available for use at a moment's notice, without any need for hurried adjustments, pieces of packing and all the other snags which the weather can provide! There is no fear that, just when one wishes to put up a particularly good showing, it will have to be spoilt by muttered apologies and remarks about small railways suffering from our home climate!



One of the cast aluminium trestles

We understand that castings are now available, and we think that they should be become popular among "live-steamers" who wish to build their own track sections. Enquiries should be made of Lamedos Industries Ltd., 92a, High Street, Eton, Bucks.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by stamped, addressed envelope, and addressed: "Queries Dept," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered within the scope of this service.

No. 9792.—Miniature Magnetos
J.F.T. (W. Hartlepool)

Q.—I would be obliged if you would inform me if any firm manufactures model magnetos. I require one to give four sparks per rev. if possible, for a marine model four-cylinder 2-stroke petrol engine I am constructing.

R.—Miniature magnetos are produced by Miniature Ignition and Accessories, Kirby Close, Ewell, Surrey. There is no miniature magneto at present on the market which produces four sparks per revolution of the magneto rotor itself. The usual method of obtaining ignition for a 4-cylinder 2-stroke engine is to run the magneto at twice engine speed and use a 4-point distributor on the engine shaft. This necessitates a high rotor speed, but this is not harmful to the modern type of rotary magnet magneto. It is, however, quite possible to construct a miniature magneto to give four sparks per revolution, and a description of such a magneto known as the "Atomax," can be found in our hand-book *Ignition Equipment*.

No. 9793.—Lapping the Softer Metals
J.D. (Brighton)

Q.—When using phosphor bronze, brass or gunmetal cylinders, I have found that, when finishing the bores by lapping, there has been difficulty in getting rid of the abrasive. In fact, the cylinder walls appear to become "loaded" themselves. After lapping and having turned a brass piston to a nice sliding fit, the latter, after a few minutes running, has all the nice circular polish taken off and in its place I find longitudinal score marks. Perhaps you could give some advice.

R.—The instructions regarding lapping generally refer to cast-iron or steel cylinders. In the case of softer metals, there is, as you suggest, some risk of the abrasives becoming embedded in the surface of the metal and retaining an abrasive action when the cylinders are put into use. This can, however, be avoided by using abrasives of a comparatively mild nature, such as brick dust or pumice powder, which do not tend to embed themselves so readily in the metal and are fairly easy to remove when the lapping process is finished.

Our general experience, however, is that if sufficient care is taken to shade off the lapping process by gradually reducing the coarseness of the abrasive, finishing with very fine abrasive such as Tripoli or rouge, and the most scrupulous care taken to remove the abrasive afterwards, the trouble referred to will not occur.

No. 9790.—Converting Gun Camera for Projection Purposes
C.W. (Congleton)

Q.—Can you give me any information regarding the conversion of an ex-Government G45 Gun Camera 24 V to projection purposes. It is desired to retain the motor and existing gears. What type of lamp and optical system will be required for a throw of about 10 ft.-12 ft. with picture of 3 ft. × 2 ft.? In several of the commercial jobs, the film is rewound in correct sequence for showing again by simply replacing the container as for first showing. How is this accomplished? The adaptor will need to be reversible through an angle of 90 deg. for horizontal and vertical format frames.

R.—The chief disadvantage of using a cine-camera mechanism for projection purposes is that the type of claw mechanism does not give a very rapid shift, which tends to reduce the length of time that the illumination can be utilised, and therefore reduces the brightness of the picture; also, that the single aperture shutter will cause flicker. We suggest that the same type of optical system and illumination as that used for the "M.E." home cine-projector would be suitable for use under the conditions specified. Particulars of this system, with detail drawings, can be obtained from Roox Products Ltd., Wellhouse Road, Beech, Alton, Hants.

The method of taking up the film so that it does not require re-winding before showing again, consists of feeding the film into the centre of the take-up container, but we have no exact details as to how this is done in practice. Reversible film holders are not generally used on single-frame film-strip projectors as practically all the standard film strips available have horizontal pictures. It is, however, quite usual to provide this movement on projectors for double-frame film strips.

PRACTICAL LETTERS

Electric Clock Contacts

DEAR SIR,—I am not very happy about the reply given to D.B.G. (Sheffield) in response to his query (No. 9777) on the above subject.

When his contacts open, quite a healthy voltage is developed across them even after the inductive "kick" has disappeared. On d.c. mains this voltage is equal to mains voltage; on a.c. mains it will depend upon the relative impedances of the magnet coil and the 1-mfd condenser across the contacts, but in either case the contacts are likely to close at an instant when the condenser is charged to a maximum. The contacts then short-circuit the charged condenser and the resulting current (theoretically infinitely great) is practically certain to damage the contacts and may even weld them together.

To prevent this, it is necessary to connect a resistance in series with the condenser, thus limiting the short-circuit current.

The best values for condenser and resistance depend on the inductance of magnet coil—I would suggest 0.1 mfd and about 1,000 ohms as a starting point from which to experiment.

Yours faithfully,

Birmingham. G. JACKSON.

Ploughing Engines

DEAR SIR,—I was very pleased to read Mr. Henry A. J. Lawrence's article in the April 6th issue of THE MODEL ENGINEER. Being a steam and diesel fitter by trade, I can appreciate the steam side all the more, and myself would be very happy driving and keeping in order two engines like those; but, after all, a man must go where the £.s.d. are. The same excuse (no drivers) was given during the period of the steam wagons. It has not been often appreciated that the driver of a steam engine, or vehicle, was always the first to commence in the morning and the last to finish at night, in addition to having periodically to carry out boiler-washing out, gland packing and various other odds and ends. No wonder the young ones prefer an i.c. job; the hardest repair carried out then will be changing a set of plugs over, any heavy repairs being sent to a garage.

Yours faithfully,

Hull. "STEAM LOVER."

Track-cam I.C. Engine

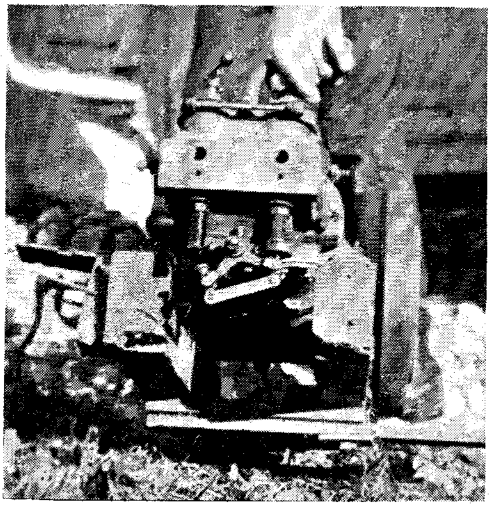
DEAR SIR,—Amongst the crop of internal combustion oddities unearthed by "E.T.W." in No. 2546, of THE MODEL ENGINEER, mention is made of the motasacoche and V-Twin Daimler engines as having track-cam valve actuation. The latter is certainly a new (old) one on me.

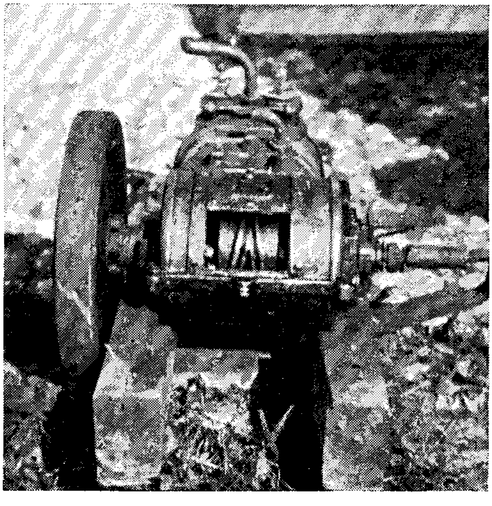
The photographs reproduced below may be of interest in this connection. They depict an 1897 6 h.p. "flat" twin Peugeot car engine. Both pistons reciprocate together, and a bronze drum between the two big-ends carries the track on its periphery, and shows up in the photograph at the cross-over position. The exhaust valves are operated by a rocking shaft, the other end of which has a crank arm with a piece pivoted on its end, rather like a double-ended boat in appearance, which lies in the track-cam groove. The inlets are automatic.

Originally a form of governor gear was fitted, which tilted the tappets inwards so that they missed the exhaust valve stems after a certain speed was reached. This gear was no doubt removed when the tube ignition was scrapped and coil ignition fitted. I bought the engine in 1928, when it was in use driving a circular saw, and both the engine and original carburettor, which turned up a little later, are now on loan to the Science Museum, reference: Land Transport, 11, Mechanical Road Vehicles, Nos. 126 and 197.

Yours faithfully,

Bognor Regis. C. S. COWPER-ESSEX.





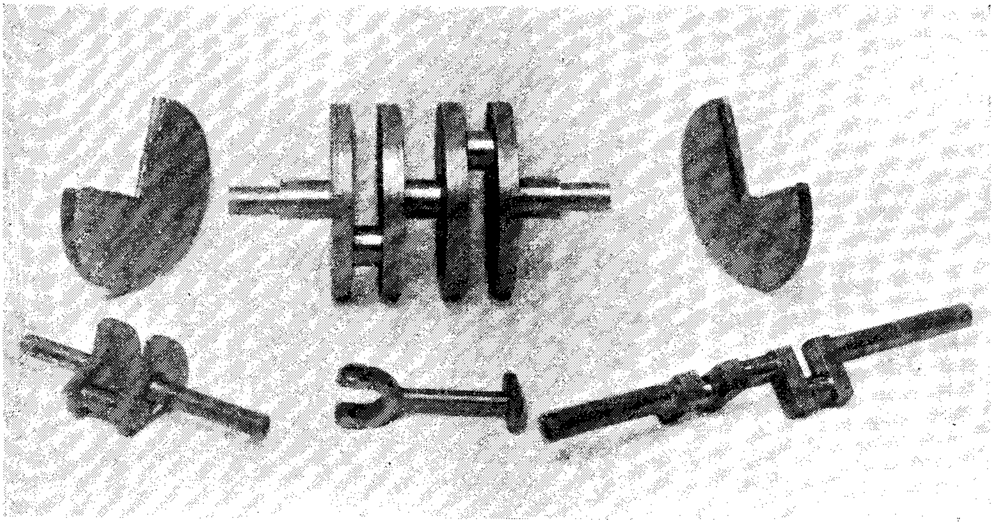
Turning a Crankshaft from the Solid

DEAR SIR,—I note with considerable interest and a degree of satisfaction, that Mr. Charnley's method of "turning a crankshaft from solid," as per his article in the February 23rd issue, varies but little from that used by myself and described in our pages of March 8th, 1934. In those seemingly far-off days I had no miller, so resorted to drill-press and my very good friend the hacksaw to remove surplus metal between webs and so reduce the amount of eccentric cut-and-come-again turning to form the crank-pins. Whereas Mr. Charnley's was from 3-in. bar, my own was from $2\frac{1}{2}$ in., but using treadle motion on 5-in. lathe and no back gear either, although I had power at my disposal. The time taken was somewhere in the neighbourhood of 24 hours, 23 being taken for a marine job with 4 eccentrics, 2 throws and some 8 in. long overall. I had a craze for crankshafts and connecting-rods in those days. Used to do them, "as and when" and put engines round 'em in like manner.

I offer my congrats. to our friend. He's surely turned out a fine job, and I am very pleased to note that he has appreciated the saving of nerve-strain by the "gapping" method. Nevertheless, should I ever sum up enough courage to do another—his size this time—I should still resort to the old pals, drill and saw, though now possessing a couple of millers. I rather fancy I should save time on the milling set-up, whilst the saw just comes natural. I can say with truth I've used one almost every day (six a week), since 1923, and very many "Seventh Days" thrown in when the exigencies of case demanded.

Again may I say to friend Charnley—"I *do* like your crankshaft."

In conclusion, might I suggest that authors



Above—Locomotive crank axle, two-throw, $1\frac{5}{8}$ in. stroke, turned by Mr. H. J. Dyer from solid mild-steel bar. Showing method of removing metal between webs. The two smaller cranks are $\frac{3}{4}$ in. stroke

Machined by Mr. Dyer from $2\frac{1}{4}$-in. bar. Roughed to $\frac{1}{16}$ in. oversize in six hours, finished complete in 23 hours

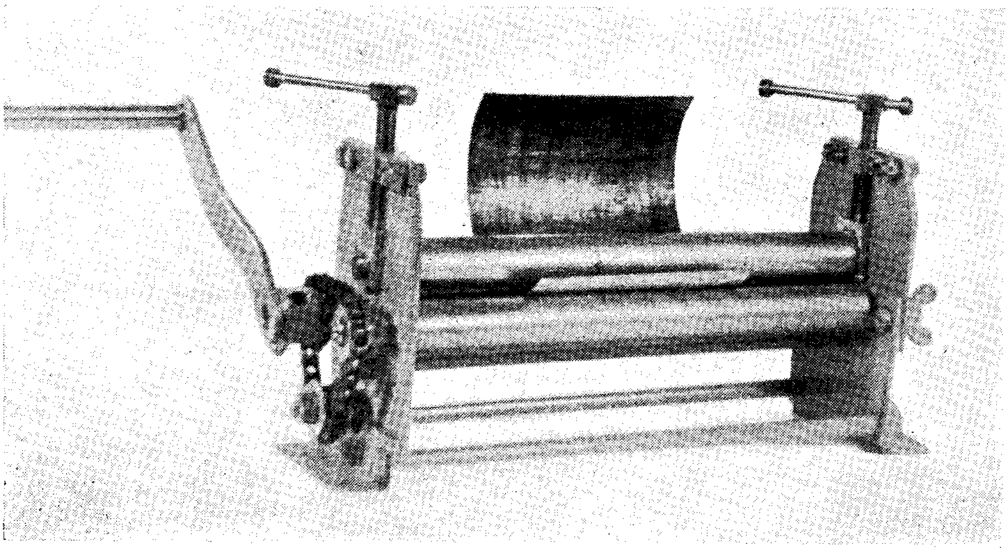
of illustrated lathe or other machine tool articles give the make of lathe used, as very often some vastly intriguing fitment or point of interest in lathe design may be lost to the reader who may be quite unable to recognise the make from what is shown in photographs.

More than once I have got out my catalogues and vainly tried to put a name to a lathe shown in part, some point or other of which has greatly interested me . . . and doubtless, others, who, perhaps, are not so cheeky as myself and refrain from requesting a further modicum of information.

Yours faithfully,
Penzance. HERBERT J. DYER.

Plate Bending

DEAR SIR,—The photograph reproduced herewith shows a set of small plate bending rolls which I have recently completed. As the little machine aroused considerable interest at a recent exhibition, it occurred to me that it may be of more general appeal. Such a machine will, I think, be a novelty to many model engineers and if readers are interested I could give a fuller description, etc.



The rollers are 1 in. diameter, the width between the endplates is $9\frac{1}{2}$ in., and one endplate is removable to allow withdrawal of the rolled material. I have not completely proved the machine's capacity, but I have rolled $\frac{1}{16}$ in. steel plate over 3 in. wide and I think 16-gauge copper, well annealed, could be handled up to its maximum width of 9 in. The minimum inside diameter rolled is about $1\frac{1}{8}$ in., depending on the spring of the material.

Yours faithfully,
Buxton. WILLIAM JACKSON. A.I.M.Mech.E.

Ploughing Engine Repairs

DEAR SIR,—I was extremely interested in Mr. Lawrence's article on "Old Ploughing Engines" in THE MODEL ENGINEER for April 6th. I was apprenticed at a local firm which combined general engineering with steam ploughing by contract having five or six sets of "tackle." Whether I ever worked on the "Twins" I do not know but the details are very familiar. It was the job of the thinnest apprentice to enter the boiler through the "manhole" and replace any leaking bolts which held the cylinder on to the boiler. As it was sometimes soon after the water was drained, you can imagine the temperature in such a confined space.

It was quite an art sliding in feet first through the manhole, feet towards firebox crown and lying on top of the smoke tubes. A candle provided illumination, and also came in useful for reading "Sexton Blake's," etc., while supposedly being hard at work cleaning burrs off drilled holes, when boilers were being repaired in winter! Later on, in the turning shop, I have turned a new axle in an ancient lathe which had large sections of the rack missing.

A regular job was turning iron staybolts for the fireboxes, new fusible plugs, link-motion pins and cylinder holding-down bolts. The winding drum was driven by a vertical shaft, bevel gears at the top and on crankshaft with a spur-gear sliding on feathers at the bottom. These feathers used to give trouble, so we turned new shafts with a boss and then shaped splines on it. Stub-axles on the ploughs used to break so the governor obtained some nickel-steel forgings; and the struggle I had turning these with cast-steel tools! no high-speed steel in the place.

Yours faithfully,
Stratford-on-Avon. R. G. SELMAN.